PUBLIC WORKS

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City County State

VOL. 63 DECEMBER, 1932 NO. 12

TABLE OF CONTENTS FOR DECEMBER, 1932

Construction:

Practical Details of Concrete Construction—VII. Placing Concrete in Walls. *By W. E. Barker* 24

(For other construction articles, see headings below)

Editorial 23

General:

Cutting Up Old Automobiles for Unemployment Relief 15

Highways, Pavements and Bridges:

Paving Records in Bituminous and Concrete Construction 11
Oil Content of California Roads 12
Silicon Steel Saves Money in North Dakota Highway Bridge 12
Drainage and Drainage Structures for Low Cost Roads 16
Plant Mixes and Plants 17
Radii of Curbs at Intersections 27
Ingenious Device Recovers Gravel Surfacing 27
Development of New Mexico Road Oil Formula 28
Purchasing Highway Equipment for Counties 33

Sewerage and Sewage Treatment:

Beautification of Sewage Treatment Work Sites. *By Col. Lewis E. Burnside* 9
Mechanical Equipment for Sewage Treatment Works. VII. Oxidizing Beds. *By A. Prescott Folwell* 18
Machinery Used in a Rocky Sewer Trench 22
Feeds and Timed Siphons for Contact Beds 34
Variations in the Production of Sewage Gas. *By Henry W. Taylor* 34
Sludge Pumping Experiences. *By D. Y. McDowell* 38
Complete Metering of Sewage Treatment Plant 39

Snow Removal:

Equipment for Snow Removal in Michigan. *By B. C. Tiney* 30

Water Supply and Purification:

Better Water at Less Cost for Lebanon, Tenn. *By H. F. Wiedeman* 13
Breaks in Cast Iron Mains; Causes and Remedies. *By Thomas F. Wolfe* 21
The WATER WHEEL 25
Ferric Chloride Notes 34
One-Hour Maximum Water Consumption 39

PUBLIC WORKS

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J. T. MORRIS, *President*
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? ? ? Brainteasers ? ? ?

"X"-mas Is Here:

We can't allow the holidays to pass without at least a gesture toward the many Brainteaser fans who "rassle" with the problems that are handed to them every month. The Christmas problem is unusually tough, and the publishers of this magazine will award two two-year and three one-year subscriptions to the five best correct solutions to it. Solutions must be postmarked not later than Dec. 24. Winners will be announced in the January issue, if possible. And we'd like to have your reactions to "Brainteasers." Tell us if you want them harder, easier, or more of them. And now for the "X" in the Xmas problem:

The Unsold Sandwiches:

While having a drug store lunch (the only kind most of us can afford these days), just before the noon-hour rush, I noticed that the counterman had carefully arranged slices of bread and fillings all ready to make up a batch of sandwiches. The arrangement indicated that the number of slices added to the number of fillings made a perfect square. The clerk seemed hesitant about beginning the assembly of sandwiches and when I inquired about his trouble, he told me that there was too much material for his expected trade. Thinking to help, I suggested that he prepare double deckers instead of the usual type of sandwich. "No good," he answered, "then I would have twice as many slices of bread left over as I would have had fillings, and twice as many fillings left over as I would have had slices of bread." I asked him how many slices and fillings my scheme would leave, whereupon he said, "Thirteen, all told, my way." Now, how many of each kind did he think he could sell?

Returns from Last Month:

That alloy problem of last month slowed the boys down a bit. As our Mr. Wheeler says, "One has to know his three Rs, as well as his BCATLs and a few other things to solve this problem. But here they are: Antimony, 38 lbs., 12 oz.; bismuth, 33 lbs., 12 oz.; copper, 35 lbs; lead, 36 lbs., 14 oz., and tin, 36 lbs., 4 oz. Using the population estimates of the League of Nations as the nth and $n+1$st terms of a geometric series with constant ratio, we find that man appeared on earth 96,212 years ago. The answer to the vote problem is 240.

"Skull Practice"?

And WGM of San Quentin, Calif., (where have I heard of that place before?) suggests "Skull Practice" as the name of this tricky column. What's your suggestion?

BENJAMIN EISNER.

A REJUVENATION

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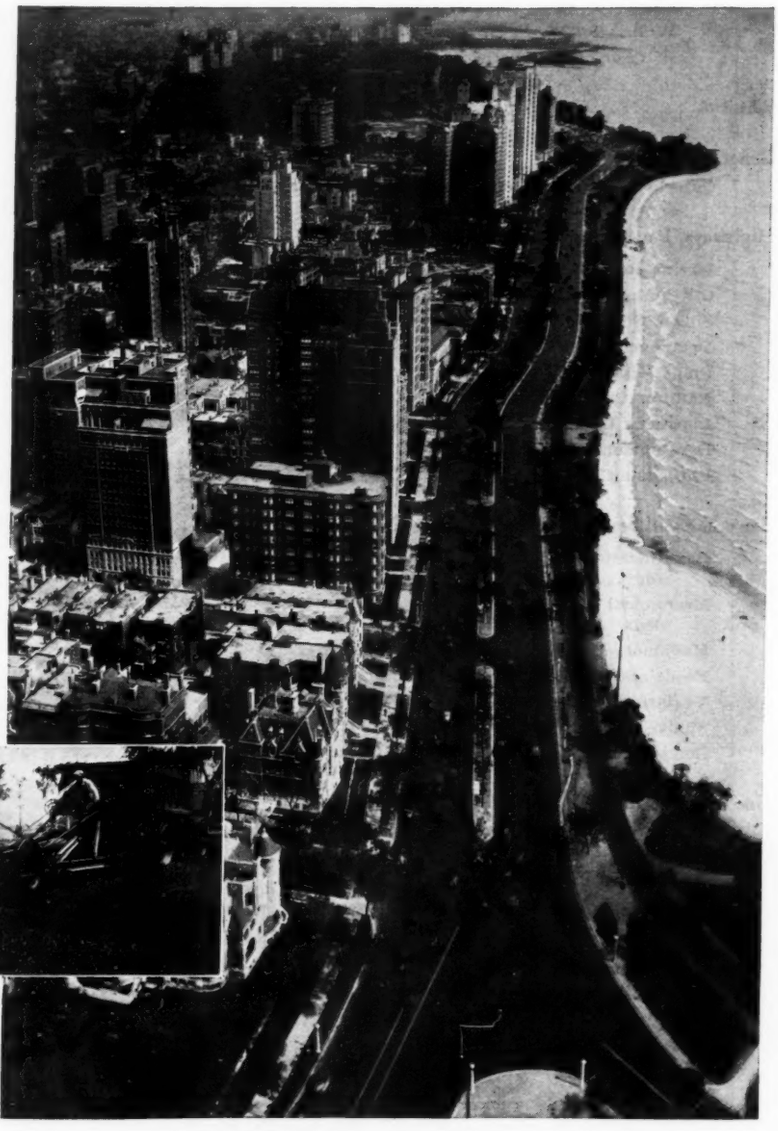
LAKE SHORE DRIVE CHICAGO, ILLINOIS

●



Lincoln Park Commissioners are entitled to credit for the perfect maintenance of Lake Shore Drive.

The west drive was resurfaced early in 1930 with Stanolind Cut Back Asphalt and mineral aggregate. This method provided a smooth even surface that has required no maintenance. The present excellent condition is evidence that it meets heavy traffic requirements.

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PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 63 DECEMBER, 1932 No. 12

Landscaping at Sharon's Sewage Plant Viewed From Entrance.
Settling tanks in foreground surrounded by barberry hedge. Administration building at right, laboratory left. Note residences in background.

Beautification of Sewage Treatment Works Sites

By Col. Lewis E. Burnside
City Engineer, Sharon, Pa.

Justification for Beautification

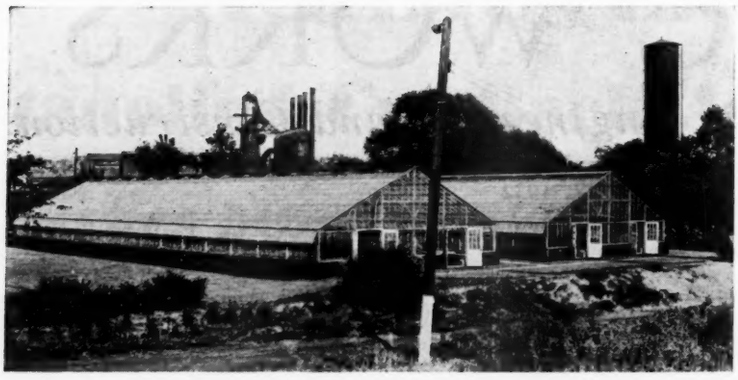
THERE are several sound reasons which justify the beautification of sewage treatment works sites, chief of which are the psychological effect and business economy, the latter factor being dependent on the former.

Because of the universal repugnance toward all matters pertaining to sewage and the lack of general knowledge by the public regarding modern methods of treating it, the impression of those not acquainted with the facts is that a sewage treatment works is a place where only odors and sights entirely obnoxious are everywhere in evidence, a place which only scavengers can tolerate and one to be avoided by all self-respecting persons. It was very largely the unholy appearance and odors given by the streams which formerly carried the sewage through or by our municipalities, rather than the edict of state governments, which influenced the citizens to vote favorably for bond issues providing funds to remove from their midst this intolerable nuisance; and this having been accomplished the imagination of Mr. and Mrs. John Public pictures the sewage disposal plant as one huge cesspool, into which is dumped the combined sewage of the community, with an attendant multiplication of the slime and stench formerly common to the polluted open-sewer streams.

It is therefore natural that the urban public is well satisfied that the treatment works be far removed from their zone of life, the farther the better. Also that any proposal to construct it within the vicinity or sight of any part of the community brings violent protest from the immediate inhabitants about the proposed site, in which they are supported by the sympathy of their townsmen and even by the courts. This often plays havoc with the well laid plans of the designing engineer, who has labored in accordance with his creed to place the works at the location which entails the least cost for the whole scheme.

As a matter of fact, no well designed and properly operated sewage treatment works gives any offense to eye or nose outside its own grounds, and seldom within them, nor is there any excuse for them to do so. In the event either or both these faults are evident, they can and should be eliminated.

By nature and training being an inventor and by



View at rear of plant showing border of day lilies and iris around glass-overs on sludge beds, and shrubs and hedge (just started) along top of sunken road where dried sludge is dumped.

necessity a genius (as his title implies), the engineer has sought and succeeded in destroying the prejudice against sewage treatment works by applying to them and their surroundings beautification which, whether simple or elaborate, is attractive and thus reduces the objections to a minimum. This is not camouflage by any means but is an application to public works of the same principle that is now commonly the rule in furnishing and finishing bath rooms in our private homes.

It is a well known and accepted fact that the sense of sight is our principal or dominating sense and so influences all the other senses. If a thing be beautiful to the sight, then the pleasure obtained by the eye outweighs any minor offense which might adversely affect the other senses.

Landscaping the grounds about a disposal plant with lawns, trees and shrubbery, even modest in extent, soon converts hostile objectors to appreciative neighbors who, as self-appointed press agents, bring others to see and learn in surprise and amazement that the place they thought should be shunned is really a quite pretty and altogether sanitary area where white men who are both clean and intelligent work and serve in an important task.

Such landscaping is neither difficult nor expensive. The many tanks used in most such plants are of necessity soundly built of enduring materials. The buildings required, usually not more than two or three in number, should be of material just as durable as the tanks and can be built using brick, stone and tile in simple, pleasing design with little more cost than plain, bare-faced or ugly structures.

One of the first sewage treatment works in Pennsylvania to put beautification in practice was the Pennypack plant in Philadelphia. I am informed by Dr. W. L. Stevenson, who was the engineer in charge of the plant operation at the time, that this had a very material effect in keeping down the cost of land acquisitions and objections in the neighborhoods where additional plants were constructed in other parts of the city.

The treatment works in Sharon, Pa., were, I believe, the first in western Pennsylvania to be beautified. They were constructed within the city limits, only about two blocks distant from one of our main thoroughfares which is solidly built up with residences, upon land which had served for years as a dumping ground—a place of tin cans, tin Lizzies, weeds, decayed vegetation and huge rats both quick and dead. The construction here was, when first proposed, seriously objected to by the property owners on the avenue, who had long kicked about the dump and assumed the sewage disposal would be even worse. They were finally mollified somewhat by our assurance that this would not be that kind of a plant, but on the contrary would eliminate what they had long detested, and, when completed, would give them pleasure rather than disgust. It was up to the city through the writer to make good, and it has done so. The place was transformed by the structures, greenhouse glass-overs, lawns, tree borders, shrubbed banks and corners, as though by magic within a period of two years, to a place of beauty and pride for the city. Visiting officials of neighboring municipalities have come, seen, and gone home and done likewise.

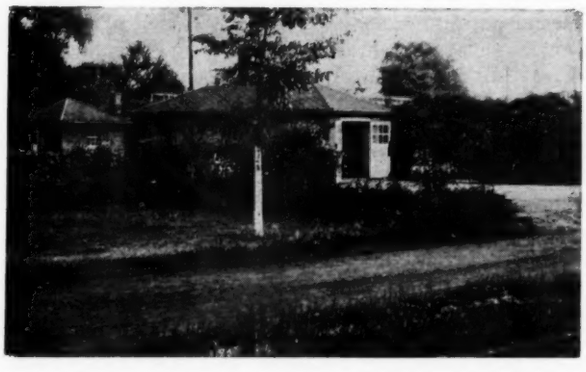
The personnel, including the common labor employed at the works, are also favorably affected and imbued with a pride in their place and their work, are unusually careful to keep everything clean and to get the best possible result with the work.

The experiences of Philadelphia and Sharon are not exceptional and are but two illustrations of many throughout the state which now number enough to prove the rule.

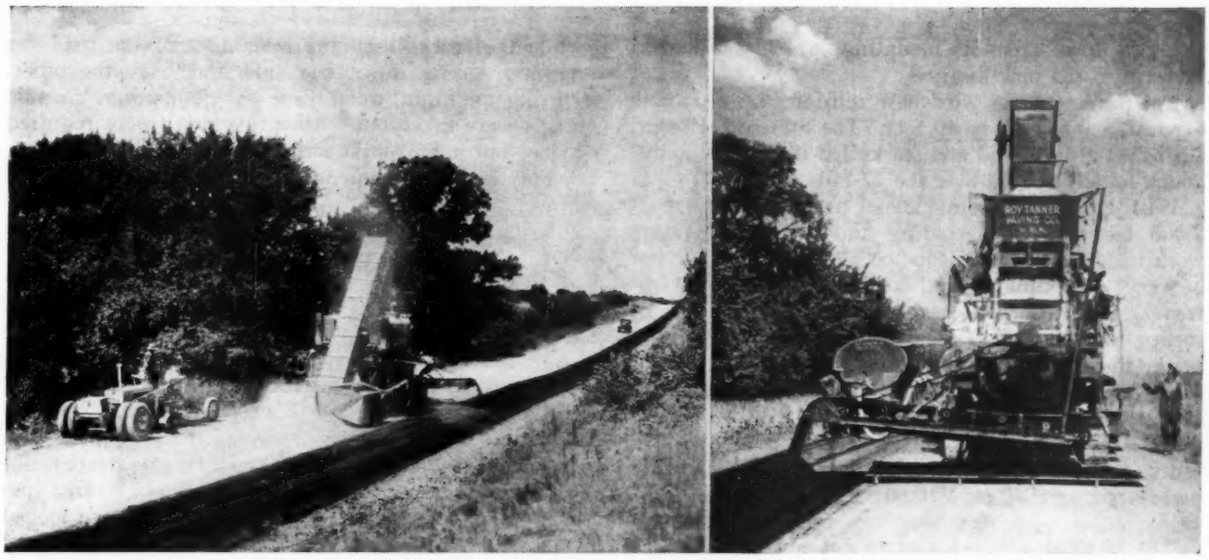
Suggestions for Application of Landscaping

First in importance in landscaping about the works is the attractive appearance of structures. Second is well graded grounds which may be level, or terraced, or a combination of the two, as best suited to the several structures, but always providing open expanses of lawns. Third is a pleasing layout of roadways needed for vehicular traffic, which should be along the boundary lines and in curves in so far as is possible, not forgetting to provide an adequate parking ground. Footpaths on lines conveniently connecting the several structures but in such location as will least cut up the lawns, though they thereby lengthen the line of travel, are very important. Native trees should be planted along the property lines and the roads following close to those lines, but such planting is not advisable along

(Continued on page 36)



View showing shrub group between parking ground and buildings, bed of low-growing perennials at right corner of administration building, and, also at right, mass of snowberry on bank of digestion tanks.



The Barber-Greene Paver at work in Kansas.

Paving Records in Bituminous and Concrete Construction

AN average of 1.26 miles per working day was the mark set last season on six projects, totalling 48 miles, of bituminous surfacing in Kansas. The first project started at Fredonia, and the final one ended 87 miles distant, 10½ miles south of Columbus. A Barber-Greene bituminous paver was employed. Work began on July 14 and ended Sept. 12. There were nine days lost in moving from job to job, including one river crossing, 4 days lost due to material shortage and 7 days from bad weather. On one stretch, 10.5 miles were completed in 5½ days and the best day's work was 11,860 feet. The work was done by the Roy Tanner Paving Co. of Tulsa, Okla.

The aggregate was delivered on the road in a windrow, and the paver picked this up, mixed it and delivered it to one side of the road which had previously been primed to a width of 10 to 12 feet. After the paver had passed, the dry portion of the subgrade was primed and the windrow of mixed material was spread by blade graders. Following this, since no finisher was used on the job, the surface was given a light rolling.

Neither the mix nor the aggregate was constant, the latter varying from chats to local limestone, with some old material from the road surface. From 50 to 75 yards per mile of old aggregate was bladed from the road, and about 500 yards of new aggregate were added. There was 17 to 20% 200-mesh material in the aggregate; 6.25% to 7.7% bitumen was used, determined by weight on the basis of a sieve analysis from the New Mexico formula. The oil was heated in the tank cars, and normally no further heating was required, although the storage tanks on the paver are provided with heaters which may be used whenever necessary.

The Barber-Greene paver is made up of two units, the loader and the mixer. A third unit, the finisher, can also be added but was not used on this job. Two men are required for operation, one on each unit, with a third man as general helper.

Three Mixers Set Concrete Paving Record

Using three concrete mixers, two in tandem and one for spreading the concrete on the subgrade, Hoeffken Bros. Constr. Co., Belleville, Ill., last season placed 19,324 lineal feet of 20-foot concrete pavement in 10 days, a total working time of 136 hours. This gives an average of somewhat more than 142 feet per working hour. The work was on U. S. 50, between California and Sedalia, Mo.

A unique arrangement of the mixers permitted this record-breaking output. The first mixer was charged as usual by batch trucks, and the charge mixed 29 seconds and then discharged into the second mixer, which was blocked up on a temporary structure at the proper height to receive the discharged material from the first mixer. The time of mix in the second machine was 31 seconds, during which period the first machine was recharged. Thus the required 1 minute of mixing was secured in about half that period.

From the second machine, the fully mixed concrete was discharged into motor trucks equipped with special bodies for handling wet concrete, and this concrete was hauled to the third mixer. No mixing was carried on here—the concrete being discharged at once into the bucket and placed on the subgrade.

The tandem mixers were set up at about half-mile intervals, and six trucks were sufficient to transport the mixed concrete over the half-mile or less haul. When the set up had to be moved, the second mixer

was run down from its mounting, which was hauled forward to the new location.

The pavement was wire-mesh reinforced, 7-9-7, with expansion joints every 40 feet. The State of Missouri furnished all material and stockpiled it at three points, about equally spaced over the 27-mile contract.

With concreting going ahead at the rate of about 2,000 feet per day, grading and other preparatory work had to be speeded up too. The old surface was of very hard flint gravel, solidified by ten years of travel. Excavation was necessary to a depth of 8 to 20 inches, totalling 135,000 cubic yards. To speed up this work, the contractors employed a "Western" No. 6 Elevating-grader with a stiff-leg device which made it possible to work such hard material. The old surface was 32 feet wide. This surface had to be used by the trucks hauling materials to the mixer and excavation had to be carried on without interference with this traffic.

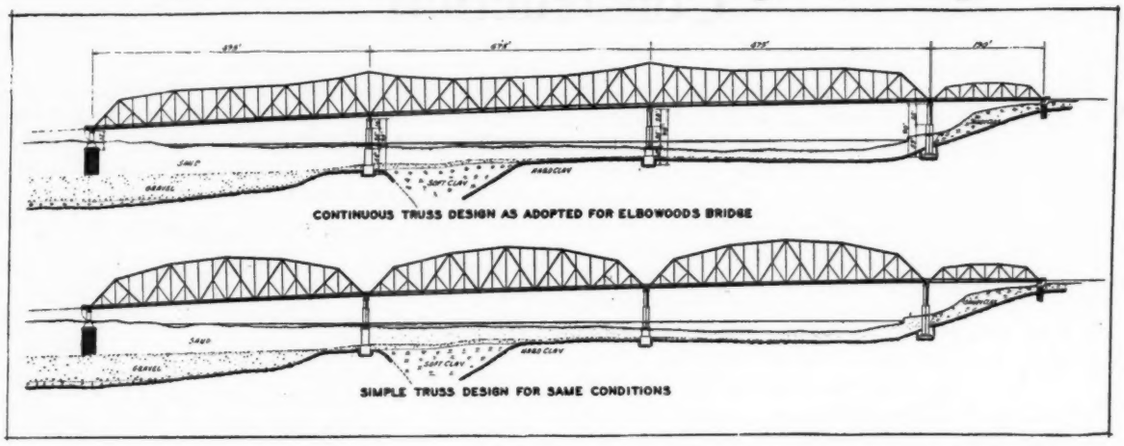
The method adopted was to cut a channel 8 feet wide down the center of the old road, casting the gravel with the elevator beyond the road bed. Meanwhile the trucks used the remainder of the road for hauling, going down one side and back the other. During the night, when there was no hauling, the side strips were taken out. About 12 hours were required to cut out a half-mile strip.

For the data herein we are indebted to the "Earth Mover."

Oil Content of California Roads

The method employed by New Mexico in determining the amount of oil to use on roads is described on page 28 of this issue. The California Department has developed a table giving the surface area of a pound of each size of material found in the road, as determined by sieve analysis; also a series of curves (one for each of ten different characters of surface), the coordinates being square feet of surface area per pound, and pounds of oil to be used per square foot of surface area, respectively. The latter multiplied by the total surface area of the sample gives the pounds of oil to be used per pound of aggregate.

Silicon Steel for North Dakota Highway Bridge



What the taxpayers want. Something just as good for less money. Upper design was $31,000 cheaper than the lower design.

A HIGHWAY bridge across the Missouri river near Elbowoods, North Dakota, contracted for this year and now under construction, has two comparatively novel features—continuous spans, and the use of silicon steel for the heavier parts. There are three main spans, each 475 feet long, constructed to act as a continuous girder. The total length of the bridge is 1622 feet. The construction cost is $299,800.

Concerning the use of silicon steel in this bridge, the North Dakota Highway Commission says in its Bulletin:

> Silicon steel is one of the high strength steels. It is not a new product or a new invention but its production on a commercial basis at a price of only ten to twenty per cent more than ordinary (carbon) steel is a quite recent accomplishment. Compared with carbon steel, silicon steel is 40 to 50 per cent greater in strength but only 10 to 20 per cent higher in price, so its economic advantage is obvious where the extra strength can be fully utilized.

The Elbowoods bridge as designed, with continuous trusses and silicon steel for the heavier parts, contains about 500 tons less steel than it would with all simple spans and all carbon steel. About 220 tons of the reduction is due to the continuous trusses and 280 tons to the silicon steel used. Using the unit price that the work was contracted for, the reduction due to the use of continuous trusses is found to amount to about $19,000 and that due to the use of silicon steel about $12,000, making a total saving in cost of about $31,000.

The quantities of the various materials in the completed structure will be approximately as follows:

1015 tons structural carbon steel.
770 tons structural silicon steel.
114 tons reinforcing steel.
4800 cubic yards concrete.
5500 linear feet timber piling.
2000 gallons paint.

The total weight of the structure will be nearly 12,000 tons.

General view of the Lebanon plant from bridge over the Cumberland river. Intake house in left foreground, filter plant in background.

Better Water at Less Cost For Lebanon, Tennessee

By H. F. Wiedeman
Wiedeman and Singleton, Engineers, Atlanta, Georgia

IF A careful analysis were made of the water supply plants in the Southeast (with which the writer is most familiar) it would be found that most of them could make improvements, the financial returns from which would amortize the investment in a few years. In many cases the returns are what might be called direct returns; that is, financial savings which show on the books of the water plant. In other cases the returns might be called indirect returns, such as savings accruing to the citizens from better insurance rates or savings to consumers due to a change from a hard water to a soft water.

The municipal water supply plant at Lebanon, Tennessee, is an example of how the complete abandonment of a hard water supply for a soft water, and the use of more efficient equipment, yield a return on the investment which not only pays interest charges and amortizes the investment in 30 years but will, in addition, yield a handsome annual return to the consumers.

The city of Lebanon formerly obtained its water supply from deep wells in the limestone, from which it was pumped by air lift to a receiving tank and then to a standpipe. The limestone formation in this section extends practically to the surface, and a successful well must tap an underground stream which flows through a series of fissures. For wells having a depth of 200 or 300 feet, these underground channels have direct connections with the surface of the ground. Dangerous pollution may therefore occur, especially when the wells are located in or close to inhabited districts. The fact that the well water at Lebanon became somewhat turbid during wet weather and that the supply decreased rapidly during dry weather, was further evidence of the relation between surface drainage and the well supply.

Much of the danger from contamination might have been avoided by drilling to depths of 700 feet or more but, in this locality at these depths, it was almost a certainty that water higher in chlorides and sulphur would be found and of such a degree of hardness that it could not be treated successfully to make it satisfactory for domestic use.

The hardness of the water from the upper strata was 325 parts per million and this could be softened to make it entirely satisfactory for domestic and industrial use, but the cost of treating this water was greatly in excess of the cost of filtering the turbid Cumberland river water, which has a hardness of 75 parts per million, even after proper allowances were made for the additional first cost of obtaining the river supply.

In order to determine whether or not the development of the river supply was sound economically, it became necessary to determine as accurately as possible the financial savings which would accrue to the

consumers and to the plant from the operation of the river supply.

The water consumption was 500,000 gallons daily and the first cost of developing the new supply was estimated to be $200,000. The cost of operation was determined as follows:

Chemicals	$ 1,080.00
Labor	2,400.00
Power	5,694.00
Supplies and repairs	750.00
Interest	10,000.00
Sinking fund—30 yrs. compounded 4 per cent	3,566.02
Total annual cost	$23,490.02

The saving in soap due to a reduction in hardness of 250 parts per million was found to be $10,500 per annum. The basis for computing this saving was that 0.1 lb. of soap is wasted for each part per million of hardness per 1,000 gallons, assuming that 2 gallons of water per capita is used for bathing and laundering. In order to get a check on this saving, a canvass of all stores in the city was made and it was found that approximately 319,000 cakes of soap were used annually at an average retail price of 6 2/3c, so that the cost of soap consumed was $21,264.00 per annum. The saving as computed was approximately 50% of the total cost while, if made upon the basis of decrease in hardness, the saving would be 75 per cent. It seems probable that the former method is conservative and more correct.

A check-up of the plumbing shops showed that replacement and cleaning of waterbacks in stoves, replacement of services and other work, caused primarily by carbonate deposists precipitated from the hard water, amounted to $6,000 per year, and that meter maintenance, due to the same causes, was $300 per year.

The total saving due to the use of a soft water instead of a hard water would, therefore, be as follows:

Saving in soap	$10,500.00
Saving in repairs to plumbing	6,000.00
Saving in meter maintenance	300.00
Total annual saving	$16,800.00

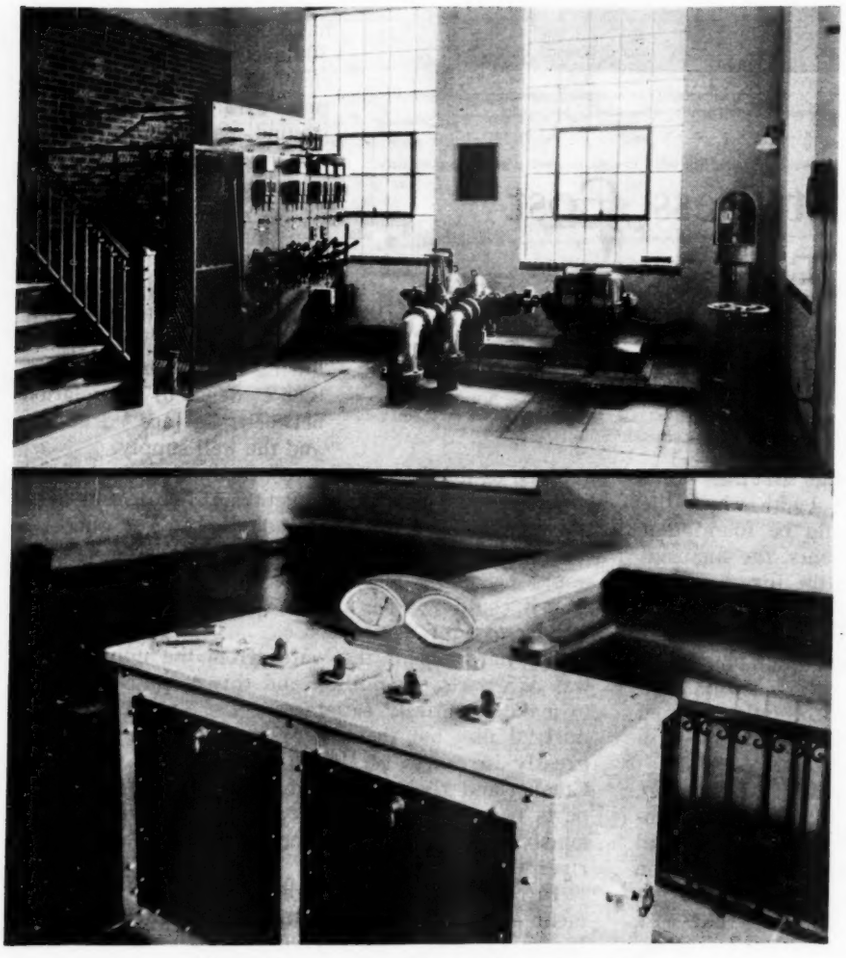
The cost of operating the well supply, without softening, was as follows:

Labor	$ 1,200.00
Power	11,588.75
Fixed charges	3,500.00
Supplies and repairs	400.00
	$16,688.75

The result is, therefore, as follows:

Saving due to use of soft water	$16,800.00
Cost of operating well supply	16,688.75
	$33,488.75
Cost of operating river supply, including fixed charges	23,490.02
	$9,998.73

This shows that, in addition to operating and amortizing the cost of the river supply, a saving of $10,000 per annum accrues to the consumer. In addition to this, there is the saving in fabrics washed in soft water, and the possibilty of obtaining industrial plants requiring a soft water for process work.

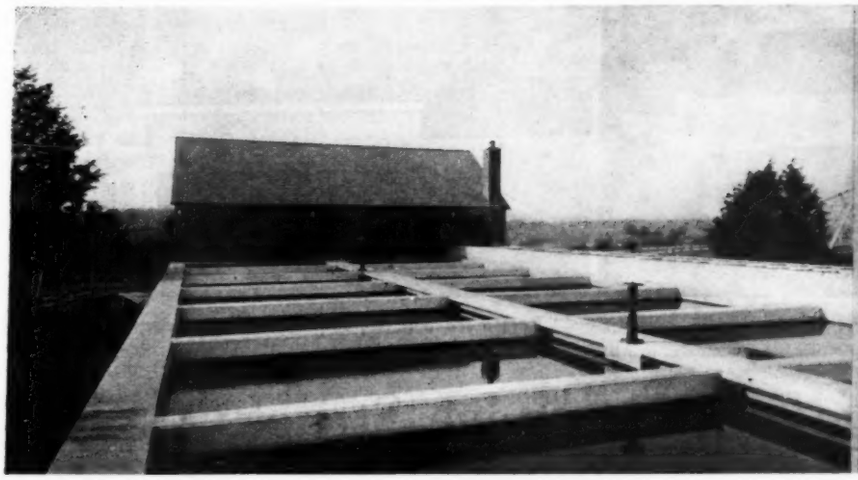


Above—Pump room. Below—Filter operating floor.

Description of Plant

The new pumping and filtration works are located about six miles north of the city, on the south bank of the Cumberland river, a solid limestone cliff rising about 65 feet above normal water surface, with an almost vertical face. The river has a maximum rise of 55 feet.

This station was constructed by sinking a shaft 18 feet in diameter through the rock to a point about 12 feet below normal water surface, a total depth of 78 feet. A 6-foot diameter horizontal tunnel about 100 feet long was then driven to the river, where intake works were located, consisting of bar screens and fine screens. The tunnel is unlined. A concrete slab was placed in the shaft about 8 feet



Coagulation basin and rear of filter building.

16-inch pipe line from filter.

above the invert of the tunnel and the shaft was lined with concrete. Pump suction lines pass through sleeves set in this slab and are connected to motor-driven horizontal centrifugal pumps of 700 and 1,000 G. P. M. capacity respectively. The discharge line to the filtration plant 16 inches in diameter is anchored to the wall of the shaft. A check valve is placed in the discharge line immediately outside the pumping station and check valves are also installed at the pumps. Shortly after the plant was completed, a 45-foot rise occurred in the river, which revealed several small leaks in the shaft lining but, after these were repaired, no further leaks occurred.

An automatic ejector is installed in the pit to eject seepage and gland leakage from the pumps. A 4-inch connection is made to the pump discharge line and carried through the suction tunnel, where it terminates in a perforated grid immediately behind the fine screens. This is used as a blow-back to clear the screens when necessary, but the intake was designed for such low velocities that practically no difficulty is experienced with leaves and trash collecting on the screens, and the currents in the river at that point are such that there are never any deposits on the rock bed, consequently no difficulty has been experienced from silting. Only during periods of low flow in the river is it necessary to prime the pumps, which is done by a motor-driven vacuum pump. Priming, starting and stopping is handled from the filtration plant, which is about 500 feet away. When it becomes necessary to increase the capacity of this station, the plan is to remove the present pumping units and install units of larger size. Sufficient space is available to develop the station to 10,000,000 gallons daily capacity.

Filtration Plant. The filtration plant consists of a gravity mixing basin, a sedimentation basin of 6 hours' capacity at 1,500,000 gallons daily rate, two 750,000-gallon daily capacity filters and a 200,000-gallon clear water well. Aeration also is provided. The first floor of the plant is also the high lift pumping station and is equipped with motor-driven centrifugal pumps, which discharge into a 16-inch cast-iron pipe line about six miles long, which is connected to the distribution system and to a steel storage tank in the city.

The old storage tank was located at an elevation which provided approximately 40 lbs. pressure on the business district, which was inadequate during fires and peak demands. The insurance underwriters felt that this pressure should be increased to 60 or 65 lbs. Since the water plant was six miles from the city and only one pipe line was available, it also seemed necessary to increase the storage. The old tank was 54 feet in diameter, 28 feet high and contained 500,000 gallons. A new tank was erected of the same diameter near the old tank and 60 feet high. After this tank had been placed in service, the old tank was torn down and erected on top of the new tank, making the completed structure 88 ft. high, with a capacity of 1,500,000 gallons. This was the most economical procedure, since the pressure on the distribution system, with empty tank, was approximately 35 pounds. A check valve was placed in the supply line where it joined the distribution system, to prevent emptying the tank in case of a break in the pipe line.

The city owns its own electrical distribution system but buys its power at wholesale from a utility company. The large capacity in storage enables the city to operate its water plant at times of off-peak in the electrical system and thereby reduces the demand charge. This saving alone will amortize the cost of the additional storage in a few years.

Old Automobiles Cut Up

Alleviating unemployment by cleaning up unsightly places has been common practice during the past two years, but when it comes to old automobiles, iron beds and other large metal objects, ordinary labor could do little unless to dig graves and bury them. According to *Oxy-Acetylene Tips*, a California town fitted up a one-ton truck with a standard oxyacetylene cutting outfit with extra long lengths of hose, which cut up the cans, etc., into pieces small enough to be removed by the village refuse truck. This was operated by an experienced cutting operator; but a crew of men was used by him for clearing away the other rubbish so he could get at the car, handling the pieces as cut up, surfacing the rubbish pile, etc. This work was continued with at least twenty men at a time for three months at a cost of a little over $1,000.

Rigid frame highway bridge in Pennsylvania.

Reinforced concrete through girder bridge, Maryland.

Drainage and Drainage Structures

Fifth in a Series of Articles on Low-Cost Roads

OF THE four major factors involved in pavement or surfacing design, the character of the subgrade soil is probably the most important. This, in turn, becomes a problem in drainage, because adverse characteristics of the subgrade soil depend primarily upon volume changes and other conditions caused by variations in moisture content. If the soil can be kept free from moisture there will be no volume variations of importance, and no damage to the surface will result from volume changes; nor from subgrade softening or frost.

In previous articles of this series, the fact has been stressed that drainage is just as highly important in low-cost roads as in any other roads, for no type of surface can maintain its integrity over an unstable subgrade. Most engineers recognize this fact, but relatively few of them provide adequate drainage.

Subsurface Drainage

In some sections of the central and north central states where the land is flat, the road bed is elevated by taking dirt from the ditches. This method is cheap and aids in keeping the roads free from snow. It is effective in that it raises the surface well above the ground water line, which also is lowered by the relatively deep ditches. These, and borrow pits, when used, must be drained, for water standing in the ditches or pits will, by capillary attraction, draw up into the roadway and rise to the surface. With earth or gravel surfacing, this evaporates; but when a waterproof surfacing, such as an oil mat, is in place, the moisture rising through capillary attraction cannot escape, and accumulates under the surfacing, causing breaks or waves in the surface.

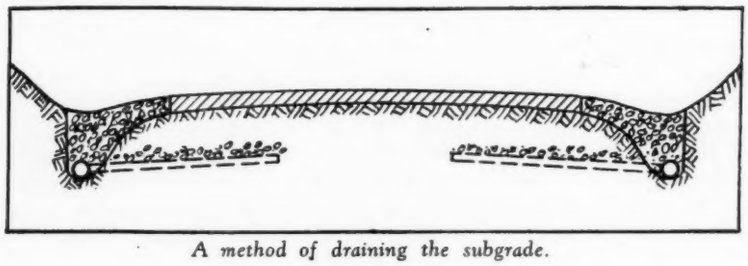
Silt pockets are a source of trouble when supplied with moisture from improperly drained borrow pits, inadequate ditches, or seepage from sidehill slopes. They may carry the moisture a long distance before finding an outlet in a cut or on a sidehill, causing break-ups or waves in the surfacing or frost boils. The only cure is thorough drainage or removal, for they will cause trouble just as long as moisture reaches them.

Subgrade and subsoil drainage may be accomplished by lines of drains down the center line of the road or in one or both ditches. The selection of the detail method depends generally upon topography and subsoil conditions. Methods of construction are adequately described in textbooks on highway engineering. Perforated pipe is especially suited for much of this work.

Surface Drainage

Side ditches, with culverts at proper intervals, remove the surface water that runs off the road or finds its way down from higher ground to the right-of-way. The slope and cross-sectional area of the ditches required depend upon local conditions. No water should be left standing in the ditches. Culverts should be spaced ordinarily at distances not exceeding 350 or 400 feet in sidehill country. It is important to get the water away from the road as soon as possible.

Culverts should not be less than 12 inches in diameter, even though a smaller pipe will carry the maximum flow expected. This costs little more than a smaller pipe and is less liable to become clogged. The culvert should not be so low as to allow water to stand in it, nor so high as to allow water to stand at the upstream end. Potholes at the lower end — along with undrained borrow-pits — provide a prolific source of mosquito production, to the detriment of the comfort, and frequently the health, of the community.

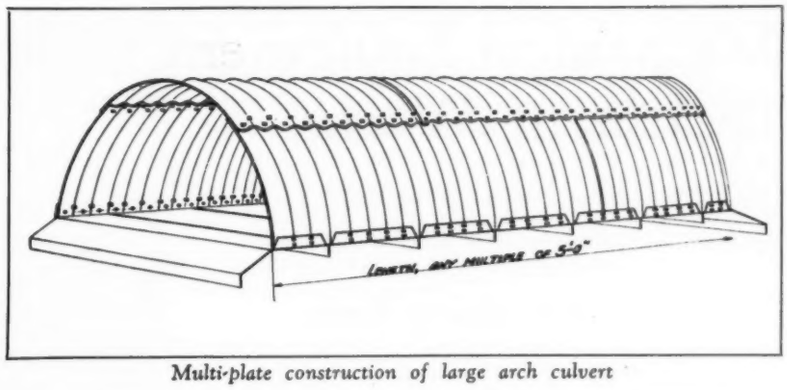


A method of draining the subgrade.

Culverts

There is no sharp dividing line between bridges and culverts — a culvert is merely a small bridge. They may be divided, however, into pipe and box culverts. The former are of tile, cast iron, reinforced concrete, and corrugated iron or steel. The latter generally are of concrete, with a few stone or wood structures.

Pipe culverts of tile and cast iron are limited in size to a diameter of about 36 inches. The latter are of especial value in rock soils or where the load is heavy, while tile culverts have small use under present day conditions. Reinforced concrete is durable and serviceable and can be made in sizes up to 120-inch diameter, but the large sizes are excessively heavy and difficult to handle. Corrugated metal has given good service in sizes also up to 120-inch, and has advantages in ease of installation and handling. A recent development is the Armco Multi-Plate construction which allow large culverts, either round or arched, to be built up on the job from standard plates.



Multi-plate construction of large arch culvert

In selecting the type of culvert, factors to be considered are relative first cost, cost of installation, delays to traffic during installation, permanency and salvage value. Initial cost is important today, as is salvage value because of tendency toward road relocation to avoid undue curvature. Ability to increase the length in case of later widening is also important.

Loads on culverts under deep fills have been a subject of considerable study, in which Dean Marston of Iowa has been among the leaders. References are available in regard to publications on this subject and will be sent on request.

Bridges

Three materials are used today almost exclusively for short-span bridges—wood, reinforced concrete, and steel.

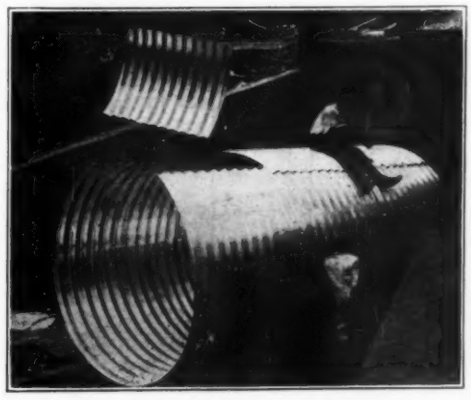
Wood bridges are usually of the timber bent type. They have advantages of low first cost and high salvage value. Under some conditions of climate and use, treated timber bridges are durable and satisfactory. Reinforced concrete in the arch and slab type is most commonly used because of ease of construction, moderate first cost and low maintenance. Steel I-beam bridges are also used commonly on spans not exceeding about 30 feet.

Factors in Design

The width of bridges should be at least as great as the paved surface of the road plus the width of the shoulders; preferably it should be even greater than this. The location of the bridge and the character of the approaches are important factors in highway safety. Unobstructed and clear approaches, with a wide roadway are of prime importance.

Considering the fact that unsatisfactory foundations have been responsible for more than 70% of the recorded bridge failures, very careful attention should be given to this factor. Adequate strength should be allowed for carrying any loads that may come on the bridge. Most county engineers use the loading standards adopted by the highway department of their state. An article in the September, 1932, issue of PUBLIC WORKS gives the essential data regarding the practices in loadings for design. It is desirable on all important roads to use the state highway or Bureau of Public Roads Standards.

Waterway area is commonly computed by the Burkli-Ziegler, Talbot's or Dickens' formula, estimated from local conditions, or guessed at. It is likely that in most cases the waterway capacity of the culvert or bridge is unnecessarily great, but this is greatly preferable to having it too small. The rate of maximum rainfall, the area of the watershed, and its character (as wooded, bare, under cultivation), and the slope of the terrain (average fall in feet per 1,000, or "flat," "rolling," "hilly" and "mountainous") are the important charactertistics. The above-mentioned formulas and an outline of the method of their application will be sent on request. The article in the October, 1932, issue of PUBLIC WORKS, "Estimating Flood Crest Runoff" by S. L. Moyer, presents valuable data not hitherto available on this subject.



Constructing Multi-Plate Culvert

Cold-Mix Plants in Low Cost Road Construction

In the article on Plant Mixers and Plants, in the November issue of PUBLIC WORKS, mention of the Farasey plants was omitted. That company makes both hot and cold-mix plants, portable and stationary, and has five of them, four portable and one cold-mix, in New York state. They also build a portable cold-mix unit on a railroad car, which can be set up readily for operation or packed for transportation. This unit consists of a 3000-pound mixer, weigh boxes, scales, bin, screen, elevator and motors, complete.

The J. D. Farasey Mfg. Co., Cleveland, O., also redesign units to increase capacities of plants of other makes.

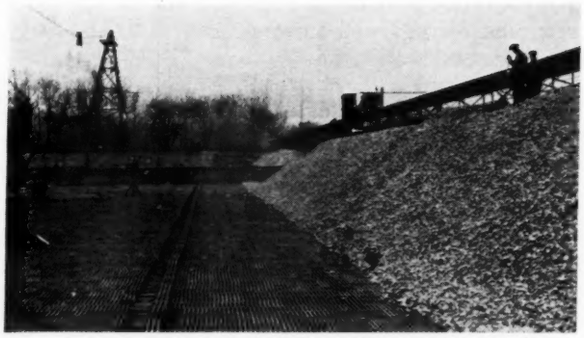
Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell
Editor, PUBLIC WORKS

VII—Oxidizing Beds

OXIDATION of sewage may be effected by bringing all of the sewage into frequent or continuous contact with air, or by the addition of oxidizing chemicals. The latter is so expensive as to be impracticable. The former has been secured by numerous methods and appliances. In the activated sludge process, air is forced into the sewage, or is absorbed from the atmosphere by all portions of the sewage being brought to the surface successively by agitation. Another method is by the use of oxidizing beds or "filters."

There are three general classes of these in use—percolating filters, intermittent sand filters, and contact beds. In the first, the sewage is applied more or less continuously to the surface of a bed of mineral particles of about 1½ to 3 inches diameter, in such small quantities that the interstices are never filled with liquid but mostly with air. In intermittent sand filters, the fine sand limits the speed of percolation of sewage which is discharged onto the surface, and the air in the pores mixes with sewage as it flows through slowly. This air, however, is soon exhausted and the bed must drain out and air re-enter the pores. Contact beds also operate intermittently, but are formed of large mineral particles in a water-tight basin, which is filled, allowed to stand full, emptied, and allowed to stand empty; a fixed time being allowed for each stage and the cycle repeated continually.



Metro floor system for sprinkling filters and stone being placed on same, at Akron, O.

Each of these operations *could* be controlled manually, and those of the last two generally were at first, and the alternate filling of sand filters may still be in a few plants. But the amount of attention required and the possibility that it may not be given at the proper intervals or may be neglected altogether makes the use of mechanical means of control decidedly desirable; and mechanism is available for this purpose which is reliable and generally secures better results at less cost than does manual operation.

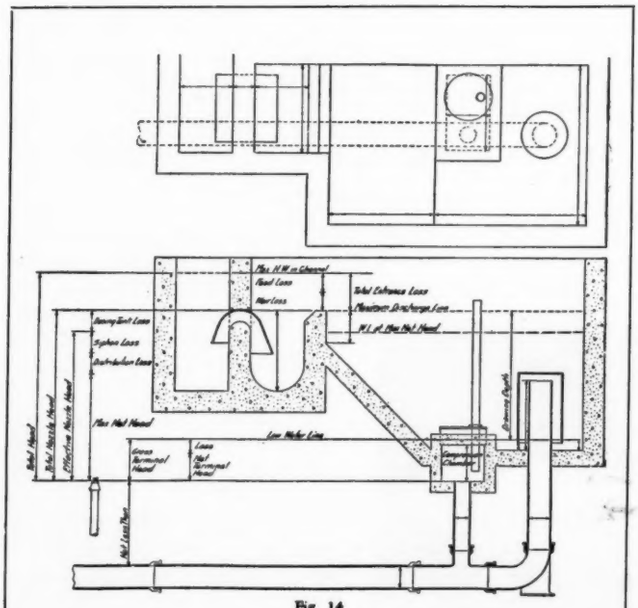


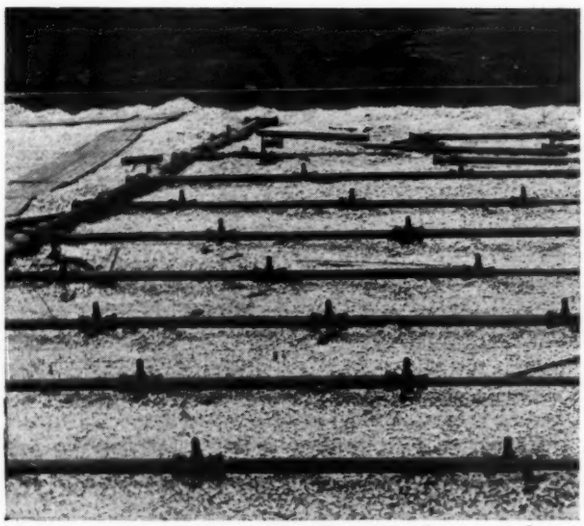
Fig. 14.

Section and half plan of twin dosing tank for separate nozzle fields

Percolating Filters

Several methods of distributing the sewage over a percolating filter have been employed, but practically all have been abandoned except stationary nozzles and movable distributors. The former have been used universally in this country until within the last few years, when a few plants have been equipped with movable distributors, which have always been used in England, and the use of which in this country is increasing rapidly.

Nozzle distribution requires the installation of nozzles and piping to feed them, and of dosing equipment by means of which the head may be raised and lowered so as to secure a distribution of the spray over the entire area of the bed. This dosing is generally secured by the alternate filling and emptying of a tank or a pair of tanks, the discharge being controlled by a siphon similar to that used in flushing sewers. When a single tank is used, variations in the rate of flow are reflected in the distribution of the sewage on the filter; also inflow into the tank during discharge tends to overdose the filter, which may cause pooling. Both of these are eliminated by use of twin tanks, which operate alternately, and this is the plan which is generally employed, especially for large plants. When twin siphons are used, both may feed a common area of bed, or each have



Special sweep fittings for nozzles, Winchester, Indiana, sprinkling filter

its own area; each of these plans has its advantages.

Different engineers and manufacturers have designed various patterns of nozzles, siphons and dosing tanks. The business of furnishing these is now practically confined to one firm—the Pacific Flush-Tank Co.—which has for years made a scientific study of principles involved and made standard designs for best securing the desired results. This company furnishes both trapless and deep-seal types of dosing tanks, but recommends the former if the distribution system can be made water tight, which should not be difficult since it is usually made with cast-iron pipe. The size of siphon should be carefully calculated, for either insufficient or excessive size will cause loss of head, and every inch of head may be a very important matter in a treatment plant. (At least 5 feet head above the surface of a filter bed is necessary for proper dosing.) To maintain a uniform discharge per square foot of bed area as the head falls, the tank is generally made smaller at the bottom than at the top. The tank is generally made of concrete in place and plans for it will be furnished by the maker of the siphon.

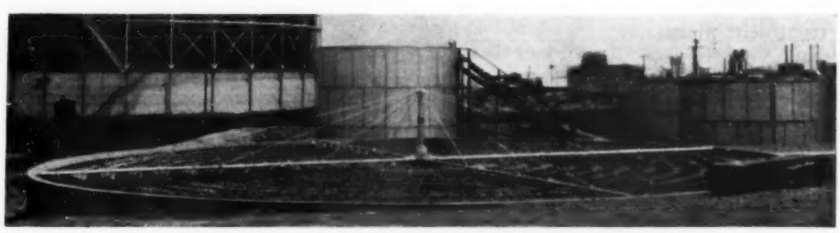
Many patterns of nozzles have been designed, some to cover a hexagonal rather than a circular area, but the latter are now little used. The nozzle should throw a spray uniform in volume at all parts of the circumference, with a minimum loss of head, and should be as free as possible from clogging and be easily cleanable when they clog, as all do more or less frequently.

The nozzles are fastened (generally screwed) to the top of vertical risers from a distribution system of cast iron or galvanized pipe, which rests either on the floor of the filter or on the surface of the bed. The nozzles fit standard threads in 1½″ and 2″ pipe, reducers being used if the risers are larger than this. For connecting the riser to the distributing pipe an ordinary T may be used; but a "Marley Tee" is furnished by the Pacific Flush-Tank Co., which contains, as part of the T, a 3″ riser extending in one piece to the nozzle at any desired height up to 60″. Another special T is made by the American Cast Iron Pipe Co., called a special sweep fitting, which is intended for use when the distribution piping is laid on the surface of the bed, and permits fastening the nozzle directly to the riser of the fitting.

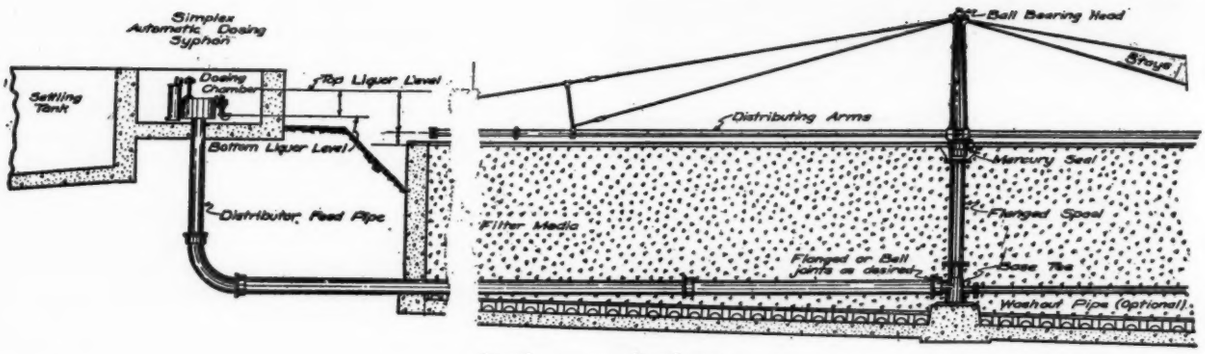
Movable distributors are either rotary or rectilinear in operation, the former requiring circular tanks. Several of the former and at least one of the latter have been installed in this country. The rotary will operate under a minimum head of 12″ to 24″ and both types are said to give more uniform distribution than stationary nozzles, consequently with less pooling of filters and less trouble from flies. It was formerly thought that severe winter weather would interfere with the operation of these, but these fears seem to have been unfounded, judging from experience with rotary distributors to date.

The rotary distributors consist of two or more (four is the most common number) horizontal pipe arms attached to a central vertical cylinder which contain a number of holes through which the sewage flows onto the bed. These openings are all on the same side of each arm, and the reaction of the discharge causes the arms to revolve. If the head and resulting velocity of discharge become too small to overcome the friction of the revolving apparatus, the arms will stand still and the sewage flow continuously on a small area under each nozzle. To prevent this, the friction should be maintained at a minimum and the quantity of sewage never fall below that necessary to cause revolution. Unless it is certain that the sewage will reach the filter continuously at this rate, a dosing tank and siphon should be used that will shut off the flow when the head falls to such a minimum. The sewage flows, usually through an underground pipe, into the vertical central cylinder and from this into the arms.

In general, all rotary distributors are much the same, differing chiefly in details of construction—materials used, strength, stability, bearings, nozzles on the arms, etc. Most if not all makes have removable caps on the ends of the arms so that these can be drained out and cleaned if necessary. The Dorrco distributor, made by the Dorr Co., has at each orifice a nozzle which is adjustable so that the volume or shape of spray from each may be changed at will. With these nozzles, fewer and larger orifices can be used, which minimizes clogging of the orifices. These distributors have been built up to 180 ft. diameter. One feature of the "Simplex" (made by the Simplex Ejector and Aerator Co.) is a mercury seal between the base and the revolving pillar which carries the arms. The P F T (Pacific Flush Tank) distributor



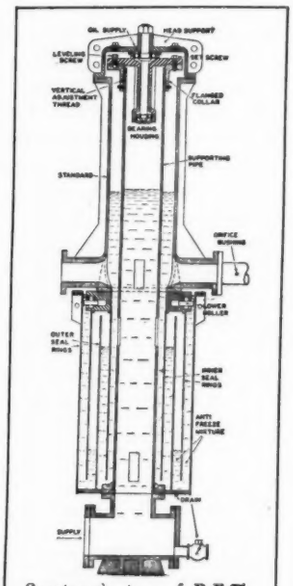
150-foot Dorrco distributor in operation at Long Beach



Simplex rotary distributor

has two inner and two outer seal rings in the base and two sets of bearings. The Simplex Valve and Meter Co. is the representative in the eastern part of the United States of Francis Hankin & Co., American agent for the Adams Cresset, an English revolving distributor.

Rectilinear distributors move forward and back for the full length of the filter, travelling on wheels which run on the side walls and propelled by a motor, either carried on the distributor or fixed at one end of the tank. The sewage is fed onto the bed from the distributor through openings in it, or by flowing in a thin film over the edge of a trough, which must be perfectly level and is sometimes serrated. No head is required except to carry the sewage into the distributor trough, and dosing equipment is unnecessary.



Sectional view of P.F.T. rotary distributor.

For removing the sewage after passing through the filter, drains of some kind are necessary. These may be built as troughs in the concrete floor, or special materials may be used. A vitrified block made by the Metropolitan Paving Brick Co., used as a cover for a trough system, is shown in the illustration. This photograph illustrates the enormous amount of stone required for a sprinkling filter, which makes this type of filter a very expensive feature of sewage treatment plants.

Contact Beds

Contact beds also are composed of large mineral aggregates, but the sewage is applied to them by means of stationary troughs or pipes, and special equipment is confined largely to apparatus for feeding and discharging the sewage at regular intervals. There are four phases to a cycle—feeding, standing full, discharging, and standing empty; and the common practice is to arrange the beds in units of four, the four beds being fed in rotation. As discharging should occur for each bed after a fixed interval of standing full, the feeding and discharging apparatus are preferably connected and located adjoining, although they may be at opposite ends of the bed. The apparatus is somewhat complicated, as shown in the illustration of that made by the Pacific-Flush Tank Co. (page 34).

This type of bed is now seldom installed and no further description of the apparatus will be given.

Intermittent Sand Filters

Intermittent operation of sand filters is secured by regulating the flow *onto* the bed only. Uniform distribution over the bed is secured best by flooding it as quickly as possible. Therefore the best plan seems to be to allow a tank to fill with the amount of sewage proper for a dose, then discharge it quickly onto a bed. If it fills before this bed has had sufficient time to drain and be reaerated, it should be discharged onto another bed. Several beds may be used, to be dosed in succession. This can be done by hand, but convenience and danger of neglect by the attendant suggest mechanical equipment. The Pacific Flush-Tank Co. manufactures a siphon, or a set of siphons arranged to dose several beds in rotation. The size of these should be such that the rate of discharge at the minimum head is at least 25% in excess of the maximum inflow. The drawing depth of the siphon should be not less than 1½ feet and seldom exceeds 5 feet.

This apparatus should be protected from weather and tampering by a substantial building, large enough to permit convenient access by the operator and make it easy for him to inspect the apparatus and see that it is operating regularly. This applies to the apparatus for contact beds also.

Intermittent sand filter with iron pipe distribution system, Aurora, O.

Breaks in Cast-Iron Pipes; Causes and Remedies

Conclusions From an Investigation of Pipe Systems Throughout the Country

By Thomas F. Wolfe
Research Engineer, Cast-Iron Pipe Research Association

AN investigation of the causes of breaks in a number of properties throughout the country and by a number of disinterested observers shows the causes to be as follows, in the order of their importance:

1—Settlement.
2—Poor Construction Practice.
3—Temperature Changes.
4—Vibration and Fatigue.
5—Pressure Changes.
6—Defective Material.
7—Electrolysis.

1—Under "Settlement" is included the settlement of ditches in which the pipe is originally laid, settlement due to the construction of adjacent structures and the settling on to the pipe itself of other structures, such as conduits, sewers, subways, retaining walls and other things.

The remedy for the first lies in the proper preparation of the ditch that will receive the pipe and in proper backfilling. By proper preparation is meant the avoidance wherever possible of disturbing the earth below the bottom of the pipe; except that where rock is encountered an excess of at least 10″ in depth should be provided and the bottom of the ditch filled with earth properly tamped before the pipe is laid. After the pipe has been laid, backfilling should receive as careful attention as any other part of the pipe construction job. Loose material only should be used, and this material should be thoroughly tamped under the pipe at least half way up the diameter of the pipe. It is important to keep in mind that the backfilling underneath the pipe should be tamped. Very often, due to the necessity for keeping ditches open until a test is made, there is more or less caving of banks, with the result that some loose material gets under the pipe before backfilling starts, and there is some danger that this part of the backfill will not be compacted.

The settlement of pipe due to the construction of other underground utilities can only be avoided by exercising proper care, during the construction of these utilities, to insure that the pipe is properly braced, that parallel trenches are properly sheeted and that other structures are so built that when they settle they will not rest on the pipe. The practice of protecting existing lines from damage during construction is quite common among gas companies, but unfortunately many water departments do not exercise the same care as the gas companies in this regard.

2—"Poor Construction Practice" includes faulty handling of pipe, faulty design and poor judgment in carrying out construction of either the line itself or adjacent underground utilities. Pipes should never be dropped on hard pavements, and it is a good rule to folllow that they should not be dropped under any circumstances. The additional effort necessary to properly string the pipe along the side of the trench costs very little and is excellent insurance against breaks. Before each length of pipe is placed in the trench it should be inspected for cracks. It is much simpler to cut off the cracked end of the pipe before installing it in the line than it is after installation.

3—When installing pipe in cool weather, they should not be set all the way home. This is particularly true of gas lines and of lines carrying water that varies widely in temperature during the year. While, as a general rule, the pipe and joint are capable of absorbing the stresses due to the ordinary changes in temperature, it is highly probable that some of the unexplained breaks in gridiron systems are due to temperature stresses.

4—From time to time we hear of breaks in cast iron pipe adjacent to street car lines, railway lines and subway structures, some of which had been in service a great many years with no noticeable change in surrounding conditions meantime. It is highly probable that such of these breaks as are not definitely due to settlement may be due to fatigue stresses. Many of these lines have insufficient cover and there is no opportunity for the earth to absorb the shocks. The remedy for this difficulty is to lay pipe as far away from these influences as possible and at a lower depth. In many parts of the country the depth at which pipe has been laid in the past was determined by the depth to which frost penetrated. This may have been good practice many years ago, but at the present time, in locating a pipe line, engineers should take into account present-day street traffic and provide accordingly.

5—Under "Pressure Changes" is included additional pressure caused by water hammer as well as changes in pressure conditions since the pipe was installed. Pipe ordinarily used in gridiron systems is capable of withstanding a much higher pressure than that at which it is rated. However, the rapid shutting of valves or fire hydrants or the sudden stoppage of use of water after a fire may result in a water hammer that raises the pressure to a figure that approaches the danger point. These additional pressures will search out the weak point of the pipe line, which may be a point that is already stressed to an excesssive amount because of settlement, temperature changes or other influences. In many systems, due to a change in the source of supply or method of distribution, pipes that at one time were required to carry water at a very low head are now required to withstand higher heads. Here also the combination of the greater pressure with other stresses may result in a fracture of the pipe.

6—Every effort is made by the pipe manufacturers to produce good material, and every effort is made by the pipe purchaser to inspect this material to see that it meets his specifications. None of us are perfect; consequently, from time to time, some imperfect material will show up. The best remedy for faults due to imperfect material lies in a rigid test of the completed line at a pressure in excess of the pressure under which it will be called upon to work. The pipe should be kept under this pressure for several hours so that any weak points or inferior material will have an opportunity to fail and be replaced before the line is actually put into service.

7—Electrolysis as a reason for failures in gridiron systems has, during recent years, become comparatively rare, and when experienced can only be taken care of by proper precautions in handling the return current in street car systems.

Frequency of Breaks

Before leaving the subject of breaks a few remarks regarding the frequency of breaks is not out of order. The number of breaks to be expected in a distribution system depends largely on local conditions. In cities where the underground system is continually disturbed it is reasonable to suppose that more breaks will be experienced than in smaller towns where such is not the case. It is the practice in Detroit to keep a record of the number of breaks in the gridiron system. The Water Department report for the year ending June 30, 1929, stated that 121 breaks were experienced during that year. As their system at that time comprised 2,757 miles of main, this means that they had .044 of a break per mile of pipe; or, to put it another way, one break in each 120,000 feet of pipe. During the year ending December 31, 1931, the city of Chicago experienced 142 breaks in 3,692 miles of pipe, equivalent to .038 of a break per mile of pipe, or one break in each 137,000 feet of the system. The Citizens Gas Company of Indianapolis experienced 290 breaks in a period of 16 years in an average of 350 miles of pipe, or .052 of a break per mile of pipe per year, or one break per year in each 102,000 feet. This figure is larger than either that of Detroit or Chicago, due principally to the fact that many of these breaks were in 3″ pipe, a size not ordinarily found in water distribution systems. If we eliminate the breaks in this size, we find that one break per year was experienced in each 157,000 feet of main. In the case of the Indianapolis Water Company, 222 breaks were experienced over a period of 35 years, an average of 6.35 breaks per year in a system that now comprises 633 miles of pipe.

Included in all of the breaks mentioned are cases of split pipe where the actual leakage was very small and where the cost of the repair was slight. On the whole, the experience of the four properties mentioned, which is fairly representative of systems of the sizes involved, is indicative of the fact that in spite of changed conditions under which old pipe are called to work they still function with remarkable success. With our present knowledge of metallurgy and with modern foundry practice we believe that present day pipe will give an even better account of itself. This will be doubly true, due to the knowledge that waterworks men have gained from past experience and because of the greater degree of skill exercised in present day water works construction.

The above paper was read by Mr. Wolfe before the American Water Works Association at Memphis.

Machinery Used in a Rocky Sewer Trench

Two features out of the ordinary marked the construction of 16 1/3 miles of sewer in Missoula, Mont., for which Hartenbower Bros. Co. contracted at about $464,000. The job involved approximately 135,000 cu. yd. of excavation, to a maximum trench depth of 20 ft., a large part of the trenching running through rock that had to be blasted. The sewer was of pipe 8 to 30 inches diameter.

In blasting, a considerable part of the rock was broken into pieces too large to be used in backfilling, and was hauled away. A considerable part of the excavation, in both earth and rock, was done with a trench hoe (Link-Belt, type K 25) equipped with a ¾-yard bucket. Rocks too large to enter the bucket were removed by means of slings hooked onto the bucket. Some of the rocks removed were as much as 5 cu-yd. in volume.

A considerable part of the construction was through alleys, where there was little room for piling excavated material for backfilling. Here a portable conveyor, set parallel to the trench, was used as a backfilling machine. The trench hoe deposited the excavated material, including rock small enough for backfilling, onto the conveyor, which discharged it about 60 feet away onto the completed sewer.

Backfilling sewer trench with portable conveyor at Missoula, Mont.

THE EDITOR'S PAGE

To Our Industry—May This Christmas Be Merry and the New Year a Prosperous One

Christmas, followed a week later by the New Year, is almost on us. To our readers and to the industry which we serve go our best wishes for a year of happiness and prosperity; and what we can do to make our wishes take a practical and useful form, we shall consider it a privilege to do.

The past year has been a trying and a difficult one. What the future will bring no man knows. But those connected with the public works field should be thankful that in general they have been more fortunate than many of their brothers. It is true that numbers of them have suffered salary cuts, yet our subscription records and other data in this office show that a relatively small number have been involved in the tremendous shifts that have taken place during the past two or three years. Training and experience fit such men to occupy positions in the community which are not only useful but necessary, no matter how great the depression; and they have more reason than most to look forward to the new year as one that will give them added opportunities of service.

So, forgetting the disappointments and the losses of the past, let us, sharing with others as we can, fix our looks upon the silver lining and make this a Merry Christmas for ourselves and others; and, setting our faces to the New Year, determine that it shall be a Happy and a Prosperous one.

For the Most Service to the Greatest Number

The George Washington bridge, Hoover dam, New York's subways and other superlative structures attract the interest of the non-technical public because of their bigness or great cost. Engineers also are interested in them, but chiefly from the same point of view—their superlativeness. Not more than one engineer in a thousand ever designs a structure at all comparable to these in magnitude, and detailed descriptions of them by technical periodicals would be of little actual benefit to the other 999 in their practice. And even to the thousandth man such descriptions are of little use in designing a similar structure, for such studies as he makes of such predecessors take the form of thorough analyses of the complete plans and reports, not a tenth part of which can appear in any periodical. It is probable that most of the new features of all big projects are designed along lines previously tried out in small ones.

Because we are convinced of the correctness of the above, PUBLIC WORKS devotes little space to the spectacular projects in its field, but confines itself to describing *especially effective* features and latest developments of proved or promising importance which could to advantage be utilized in connection with the public works of both small villages and large cities. If we should devote an entire issue to the Hoover dam, for example, we would feel that we were cheating all of our readers who are not especially interested in dams, and were furnishing only interesting rather than really useful information to those who *are* so interested.

But how to get the greatest mileage of serviceable roads for a given sum, and how to maintain them afterward; how to transform a sewage plant which is a public nuisance into a municipal pride, at a minimum cost; how to satisfy citizens of either small villages or large cities with the water they drink and at the same time with the rates they pay for it; what equipment contractors are using in their efforts to squeeze a profit out of contracts at present-day prices, and with what success; these things are of practical value to the 999, and to the thousandth man also, and we believe that it is by centering our efforts on these that we can furnish the most valuable service to the greatest number of those who construct and manage public works.

And while we are on the subject of editorial policy, there is another feature of it which we wish to explain —that of selecting, as authors of some of our leading articles, engineers who are connected with associations of manufacturers such as the Portland Cement Association, Asphalt Institute, Chlorine Institute, etc. While the aim of these associations is to promote the use of their goods, most of them realize that such promotion is best accomplished by learning what methods of using them will give the most satisfaction to the purchasers, and endeavoring to see that the purchasers employ such methods. To this end they employ engineers, chemists and other experts to carry on investigations in field and laboratory, taking cognizance of materials and conditions found in all sections of the country.

An engineer who has spent several years in such investigation and development of a given material should be better able than any one else to advise concerning its most advantageous use under all ordinary conditions. Naturally his advice would not be asked in choosing among rival materials. But having chosen his material, we would welcome his advice as to the best method of using it. We feel, therefore, that such engineers should be better qualified for writing articles describing how to use their respective materials than almost any one else that we could find.

Index for Public Works for 1932

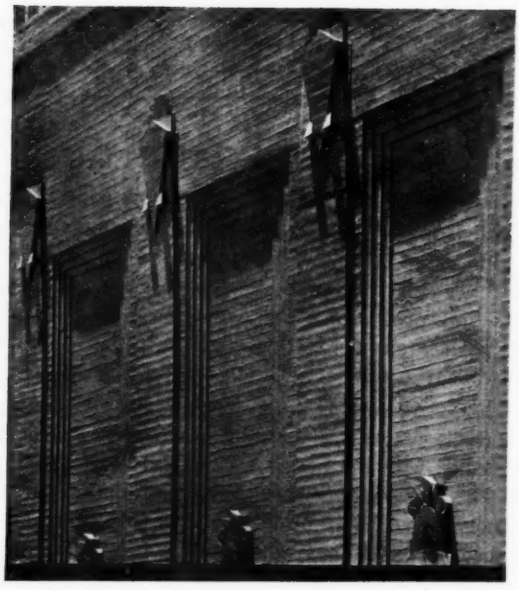
The index of Volume 63 of PUBLIC WORKS, the twelve issues published in 1932, is not published in this issue, but will be found in the January one. By postponing the preparation of this index, which must include the present issue, we can more surely avoid mistakes and make the index of more value to those who save their issues for reference—which we believe all our readers will find to be well worth while.

Practical Details of Concrete Construction

By William E. Barker

Highway Engineer, Portland Cement Association

VII—Placing Concrete in Walls



A monolithic concrete wall in which the texture is produced by the form boards. Construction joints are made invisible by placing them where they would be least noticeable and by care in their construction. Careful placing has avoided sloping pour lines and honeycomb.

IN BUILDING monolithic structures it is important to bear in mind that the concrete has a two-fold purpose—structural and decorative. Each operation has its effect on the ultimate appearance, and proper placing is essential if pleasing surfaces free from defects are to be secured.

Before placing of concrete is started, the form construction should be examined carefully, to make certain that forms are in alignment, are adequately supported and that ties are brought up tight to the spreaders. If lining materials have been used, it is necessary to correct any bulging which has occurred due to moisture. (Of course, it is better to protect the forms so that such bulging does not occur.) Any water that has collected in the bottom of the form should be drained away before concreting. Reinforcement should be checked to see that it is held rigidly in place and the proper distance from outside surfaces.

Since it is desired to produce a surface of uniform density and color, uniformity from batch to batch is one of the first requisites. This requires careful control of the concrete at the mixer, accurate measurement of all the materials, including the water, and thorough mixing. Sand streaks will be prevented by having enough cement and fines in the sand, while stone pockets will be avoided by having a plastic mixture handled and placed in a manner which will avoid segregation. Excessively large aggregates are difficult to handle except on the most massive work where there is little reinforcement to interfere with placing.

In general there are two practices often used in construction that must be avoided if concrete walls of good appearance and durability are to be produced. The first of these is dumping large quantities of concrete at one point in the wall and permitting it to flow over long distances in the form. Almost any mixture that will flow over a considerable distance in the forms will show segregation, excess water and fine material flowing out to the ends of the wall, leaving much of the coarse material at the point of deposit. The ends of the wall will then be more absorbent and have lower strength, while in extreme cases cavities may occur in the locations having excess coarse material. The practice often produces sloping "pour lines" which are indelibly marked in the surface and detract from its appearance.

It is a much better practice to place the concrete at frequent intervals along the length of the wall and in thin layers, keeping the upper surface horizontal to prevent flowing in the forms. Keeping the level of concrete in the ends of walls slightly higher than the remainder of the wall will prevent excess water from accumulating at these locations. The ends will then be of good quality concrete to withstand the severe exposure to which they are subject.

In dumping concrete directly into narrow forms, much of it is thrown against the form opposite the runway and the layer of reinforcing near this surface causes considerable separation of the materials. Dumping the concrete from the buggy into a small hopper with a short spout shaped to fit between the reinforcing and placed at the top of the form will tend to remix the concrete and keep it from segregating. Where it is practicable, the concrete should be placed through a metal or cloth spout or an elephant trunk to keep it from separating when placing in deep walls.

The second practice that must be avoided is placing a mixture that is so wet as to permit a layer of laitance to collect on the top of each layer of concrete. This laitance consists of water which has floated to the surface and brought fine materials and impurities with it. It has little strength and is very porous, and hence forms a weak plane readily subject to attack by the elements. Layers of laitance also detract from the appearance of the structure.

The consistency of the concrete should be such that appreciable water does not come to the surface as concreting proceeds. Some puddling and spading should be necessary to thoroughly consolidate the mass, prevent stone pockets and produce smooth surfaces. However, working the concrete should not be continued after this result has been reached, as further agitation will tend to draw water and laitance to the surface.

Where appearance is important, the construction joints should be definitely located on the drawings by the architect or engineer. In monolithic concrete buildings they are often placed at the floor levels or at the bottom of window openings. Concrete should be placed in the wall up to the bottom of beams and allowed to settle not to exceed three hours. The beams, column capitals and floor systems are then placed.

Construction joints may be made inconspicuous by making them coincide with a form board mark. Where concreting is to stop, a 2 by 2-in. strip of wood may be attached to the inside face of the outer form. The concrete should then be placed to a level about one inch above the underside of the strip. Before the next lift of concrete is placed, the wood strip is removed, leaving a horizontal joint appearing as a thin, straight line on the surface. The form should be drawn up tight against the hardened concrete before placing the next lift, to prevent leakage; and to prevent staining, water or laitance which does leak through must be washed from the lower surface immediately.

In placing the first layer in a new lift of concrete there is often a tendency for a stone pocket to form, due to the difficulty of spading against a hard surface. To overcome this tendency, a layer of mortar or of concrete in which the amount of coarse aggregate is greatly reduced may be placed in the bottom of the lift. This will form a cushion against which the regular mix of concrete may be spaded.

THE WATER WHEEL

Following are the essential features of the important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted. Published every month to include articles appearing during the preceding month.

WATER Diversion is treated at length by Robert E. Horton[22], in its economic, engineering and legal aspects. A stream may serve, among other purposes, fisheries and related industries, transportation, irrigation and agricultural uses, sanitary uses (dilution of sewage), public and industrial water supply, recreational, water power, and regulation and flood prevention. (Too often one of these has unwisely or uneconomically been assumed as of paramount importance.) Diversion may be made, under different conditions, to serve any one or more of these.

Among the types of diversion considered by Mr. Horton is that by pondage—diversion from one water shed to another by a tunnel leading from the bottom of a pond. When stream flow exceeds the capacity of the tunnel, the pond fills; if it continues to exceed it, the surplus flows down the original channel—waste, so far as that project is concerned. The calculation of the proportion of total flow that can be diverted is facilitated by a mass diagram similar to that shown, plotting the natural flow of the stream at the diversion point.

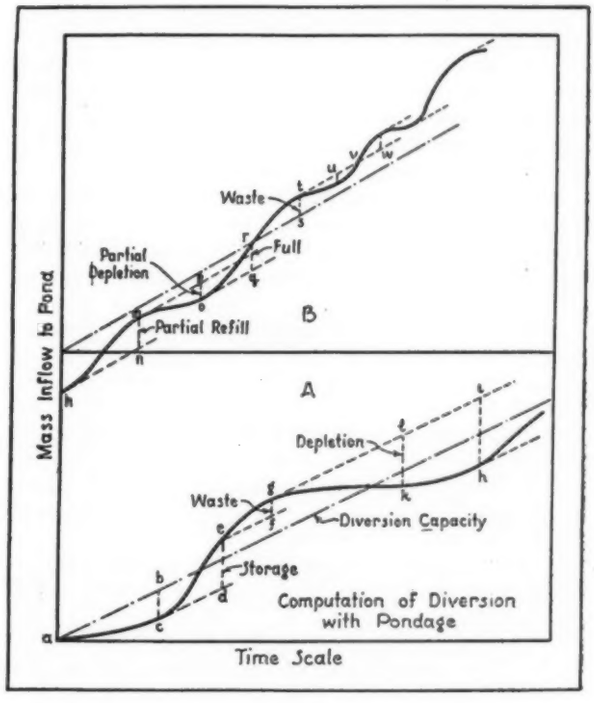
Starting with the inflow less than the diversion capacity, draw a gradient line corresponding to mass diversion at tunnel capacity, as marked "Diversion Capacity." The entire flow can be diverted until the mass inflow line becomes parallel to this gradient line. Draw a second gradient line "cd" starting at the point of tangency "c" and continue until the vertical intercept "de" equals the pond capacity. Then continue the diversion gradient from this point along the line "ef" so that the point "f" is vertically underneath the next point of tangency "g." From then until the next point of tangency "h" is reached, the inflow is less than the diversion capacity and the entire flow can be diverted. The curve is continued above in "B." The sum of the waste intercepts deducted from the total flow gives the amount diverted during this period.

Concrete Dam expansion by heat evolved in setting and subsequent contraction (see PUBLIC WORKS for November, p. 30) is to be avoided in the Hoover dam by using a cement that evolves comparatively little heat during setting and possibly also by keeping the concrete cool by refrigeration through pipes buried in the concrete[10].

A concrete dam in Norway, which is about 115 feet high, which leaked dangerously, was rendered watertight by erecting, 2 meters from its up-stream face, a vertical reinforced concrete slab 20 cm. thick at the top and 47 cm. at the bottom, supported against the dam by concrete struts 5 to 10 feet apart and having numerous expansion joints utilizing copper plates and bituminous material[7].

A Concrete Corewall 30 ft. thick at the bottom and 6.5 feet at top and 115 ft. high, hollow, with walls 10 inches thick at the bottom, moved forward 5 inches at the base and 32 inches at the top when the reservoir was filled[9]. The dam on both sides of the corewall is of rock fill dumped loosely from cars, except that, of the down-stream fill, the half furthest from the dam was hand placed. The break occurred the first time the dam was filled, four years after its completion. This was the Oued Kebir dam of the Tunis, Africa, water supply. The water was drawn off and the bottom of the hollow core filled with reinforced concrete. The author draws several conclusions, including "the fallacy of trying to support a relatively stiff seal wall by fill material which is subject to irregular and relatively large displacements," and that on refilling it will again tilt and crack, probably just above the new reinforcement.

Coagulation. Missouri river water used by St. Louis is subjected to primary and secondary sedimentation, the former either with or without coagulation[40]. Quicklime, aluminum sulphate and ferrous sulphate have been used as coagulants. The lime is added to the raw water because of the longer lime softening reaction time allowed and greater turbidity removal in primary basins. The 6 g. p. g. required for softening gives 90% average turbidity removal when turbidity



Mass diagram for computing diversion with pondage.

is over 1,000, as against 55% by plain sedimentation. This reduces the ferrous or aluminum sulphate dose needed; and alum costs three times and ferrous sulphate twice as much as lime. Ferrous sulphate is especially effective when the pH is above 9.0. The preliminary settling basins are cleaned by Link Belt continuous sludge removal machinery.

Manganese in impounding reservoirs is due chiefly to decomposition of organic vegetable matter in the bottoms thereof, resulting in an acid condition and the consequent solution of manganese. This action is particularly noticeable when hydrogen sulphide is present. Most natural waters containing manganese have too low a pH value for the rapid oxidation of the manganese[41].

"Manganese is completely removed from the soft, colored raw water at Providence by copperas and lime treatment, maintaining a pH of about 10 for coagulation. The treatment has stopped red water and manganese troubles in the distribution system and eliminated the necessity of using bleeders or dead-ends. Increases in color, hardness and iron in the effluent over the amounts contained in the effluent under alum treatment have not been of sufficient magnitude to cause concern to any except some industrial users who note the hardness change. . . . The coating of sand grains (in filters) has been negligible. . . . Experiments indicate better coagulation and settling with ferric coagulants than with those in the ferrous form[29]".

Water Meters, according to officials of the Hartford, Conn., Water Bureau[20], should all be tested regularly in service; and department or company should adopt a testing procedure with test points selected to cover the actual rates of flow at which meters ordinarily operate; a repair procedure which will insure that the measuring element of the meter is replaced before it becomes sufficiently worn to produce excessive under-registration at low flow; proper sizing of the meter to adapt it to the service expected; slightly higher accuracy requirements for the lower rates of flow in both new and repaired meters than obtain at present under the specifications which permit under-registration at low rates without permitting reasonable over-registration at higher rates (New York State).

Underground Waste detected in New York City by a special survey made in 1931 totaled 40.435 m. g. d. The total consumption is about 800 m. g. d.[25] Of this total, 42% was in live services, 38% joints in mains, and valve leaks 7%.

Pipe Breaks in the Indianapolis cast-iron distribution system during the past 35 years totaled 222, of which settlement caused 26%, electrolysis, 31%, increased fire pressure 7%, vibration from ground surface 7%, improper care of exposed pipe 7%, defective pipe 6%, freezing 4%, external blow 3½%, floods 4½%, water hammer 2%, miscellaneous 2%[26]. There were no indications of deterioration of pipe (up to 60 years old) except by electrolysis.

Bibliography of Recent Water Works Literature

c, indicates construction article; *n*, note or short article *t*, technical article.

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1. *n.* Two Gravity Water Supplies at Opposite Ends of a City. H. G. Olmsted, pp. 61-62.
2. Water Supply and Sewage Disposal for an Indiana State Institution. Charles Brossman, pp. 69-71.
3. *n.* Cucumber Taste Removed. C. J. Bruce, p. 75.

The Canadian Engineer, November 15.

4. Water Supply of the City of Windsor, Ont., pp. 23-25.
5. Water Supply and Drainage Systems Installed at Masson, Que. G. D. O'Connor, pp. 27-28.
6. Progressive Fight Against Typhoid Fever in Canada. Norman J. Howard, pp. 29-32.

Engineering News-Record, October 27.

7. Thin Concrete Diaphragm Protects Ringedal Dam. Chr. F. Gröner, pp. 498-500.
8. Steel-Faced and All-Steel Dams. M. N. Baker, W. B. Storey and James B. Girard, pp. 505-506.

November 3

9. Corewall in Rockfill Dam Tilts When Reservoir Fills. F. A. Noetzli, pp. 529-530.

November 10

10. *t.* Hoover Dam Cement Specifications Tentatively Formulated. John L. Savage, pp. 558-560.
11. *c.* Pipe Laid Across Panama Canal by Use of Cable Support. A. L. Hertz, pp. 562-563.
12. *c.* Current Dam Construction in Southern California. J. I. Ballard, pp. 564-567.

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13. American and English Water Works Practice. John T. Calvert, pp. 229-240.
14. Measures Adopted for the Control of Tastes and Odors Due to the Development of Microscopic Organisms in Spot Pond Reservoir, Boston Metropolitan District. Samuel E. Killam, pp. 241-251.
15. The Nashua Fire of May 4, 1930. Wm. F. Sullivan, pp. 252-263.
16. Use of Water in Gas-Operated Refrigerators. Superintendents' Discussion, pp. 264-268.
17. Difficulties with Water Bill Collections During the Depression. Superintendents' Discussion, pp. 269-271.
18. t. A Comparison of Methods for Determining the Areal Mean Precipitation on Drainage Areas. John B. Belknap, pp. 272-282.
19. *t.* An Automatic Transfer Fermentation Tube Battery for Determination of B. Coli in Water. William Firth Wells, pp. 283-287.
20. Domestic Flow as Affecting Meter Registration and Water Revenue. H. W. Griswold and W. A. Gentner, pp. 288-311.
21. Powdered Activated Carbon in Water Purification. F. E. Stuart, pp. 312-315.

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22. Water Diversion Between Drainage Basins. Robert E. Horton, pp. 1623-1683.
23. Expansion of the Los Angeles Distribution System. W. W. Hurlbert, pp. 1684-1699.
24. Causes of Waste in Distribution Systems. Alfred E. Skinner, pp. 1700-1708.
25. Underground Waste Detection as a Factor in the New York Water Conservation Problem. Fred B. Nelson, pp. 1709-1716.
26. Breaks in Cast Iron Pipe Gridiron Systems. W. C. Mabee, pp. 1717-1737.
27. Report of Committee on Control of Tastes and Odors, pp. 1738-1749.
28. Cross-Connections with Public Water Supplies. S. B. Morris, pp. 1750-1761.
29. *t.* Iron and Lime in Removal of Manganese. E. C. Craig, E. L. Bean, R. W. Sawyer, pp. 1762-1779.
30. Unsuspected, Unusual and Little Known Factors in Water Supply Quality. Paul Hansen, pp. 1780-1791.
31. Biological Control as Affecting Plant Operation. Carl Wilson, pp. 1792-1799.

Proceedings, American Society of Civil Engineers, November.

32. *t.* Study of Stilling Basin Design. C. Maxwell Stanley, pp. 1521-1543.
33. *t.* Design of Large Pipe Lines. Herman Schorer, pp. 1545-1559.
34. Forests and Stream Flow. Discussion. J. E. Willoughby and A. L. Sonderegger, pp. 1614-1618.

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35. Afforestation of Water Catchment Areas. A. D. C. Le Sueur, pp. 375-376.

November 4

36. London Water Supply, New Pumping Plant, pp. 405-406.

Water Works nad Sewerage, November.

37. Gravel-Wall Wells on Shore of Lake Michigan. N. F. Yonkman, pp. 384-386.
38. Some Water Works Lessons Chicago Has Learned from the Depression. Myron B. Reynolds, pp. 387-388.
39. The Need of a Reference Laboratory for Testing Activated Carbon. John R. Baylis, pp. 389-390.

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40. Coagulation Methods Applied in the Treatment of Highly Turbid Water. Herbert A. Hartung, pp. 1310-1313.
41. *t.* Neutralizing the Effects of Manganese in Impounded Water. Robert Spurr Weston and Attmore E. Griffin, p. 1314-1317.
42. Ferric Chloride as a Coagulant. Paul Stegeman, pp. 1318-1320.
43. Painting Water Tanks. A Symposium, pp. 1324-1325.

November 16

44. Seek RFC Aid for Your Meters That You May Get More Dollars for Your Water. N. N. Wolpelt, pp. 1362-1366.
45. Efficiency in the Water Department Through Adoption of Operating Economies. W. E. MacDonald, pp. 1367-1368, 1393-1394.
46. RFC Cooperation for Financing Projects for Relief of Unemployment. Harvey Couch, pp. 1369-1371.

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HIGHWAY ENGINEERING

Radii of Curbs at Intersections

AS THE radius of curb at a street intersection increases, vehicles can turn more easily; but this fact, resulting in vehicles making the turn more quickly, increases the hazard to pedestrians, and the wide curb return is inconvenient for them in limiting the sidewalk width at the corner and increasing the width of roadway to be traversed in crossing the street. The hazard is largely eliminated where there is adequate traffic control, but the sidewalk width needs consideration.

From the point of view of the automobile driver, the proper curb radius is one that will at least allow the turning vehicle to proceed in its new direction without interrupting more than one moving lane of traffic. Where there are unusually wide streets, a turn can often be made around a short radius without interfering with oncoming traffic but the turning vehicle is forced to measurably slacken its speed, and the curve should be such that a vehicle can negotiate it at a reasonably rapid pace.

Most automobiles can turn on a radius of 25 feet or under. Assuming 25 feet as a standard, Figure 1 shows the advantage of increasing the curb returns on a street carrying two lanes of traffic in each direction. The dotted line indicates a curb of five feet radius. In turning this corner the car finds itself in the position "A" and has interrupted the progress of, not only car number one, but of car number two as well. The same car turning the corner on a 15-foot radius is in the position "B" after completing the turn and has delayed only one lane of traffic, as it is not necessary for it to pass into the path of car number two.

As few drivers utilize the full turning capacity of their cars, probably on a street with about 30-foot roadway a radius of more than 15 feet would be desirable. At intersections controlled by automatic traffic signals or four-way boulevard stop signs and where the free flow of vehicular traffic is essential, a curb radius of 30 feet is becoming the standard practice in Los Angeles.

Figure 2 shows a corner with a radius of 30 feet and the corresponding cut back of the building which formerly was flush with the property lines. Had the corner of the building not been cut back, the space left for pedestrian movement would have resulted in serious sidewalk congestion and inconvenience. Such a corner can either be cut back or arcaded. It is obvious from the sketch that this corner offers a much better visibility for approaching motorists. Wherever possible, curbs should be arranged to allow the free movement of automobiles between turning street cars and the sidewalk.

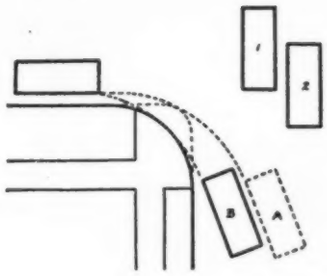


FIG. 1

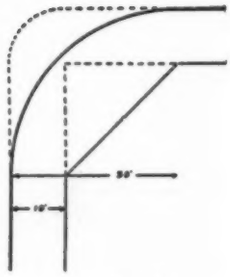


FIG. 2

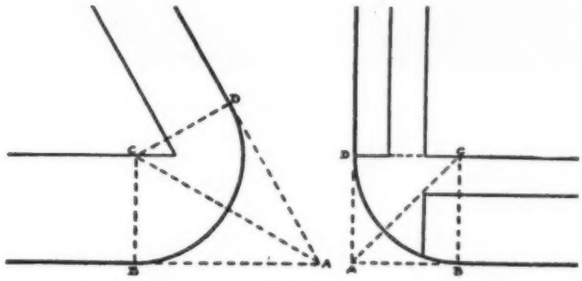


FIG. 3

In residential districts or areas where traffic is light, it is good practice to cut corners back on a radius equal to the width of the wider sidewalk and parking. This does not materially affect the sidewalk capacity and offers a safer and better accommodation to vehicles. Figure three illustrates the method of determining these radii geometrically.

At intersections of state or county highways a higher degree of safety and convenience may be obtained by laying out and paving between the roadways on a radius of 30 feet or more. As most highways are considerably less in width than city streets the practice of providing wide turning radius will eliminate the difficulty shown in Figure 1 and thereby greatly reduce accident hazards. It is of course very desirable to cut back banks or corners of buildings for the purpose of increasing the range of vision of the automobile driver.

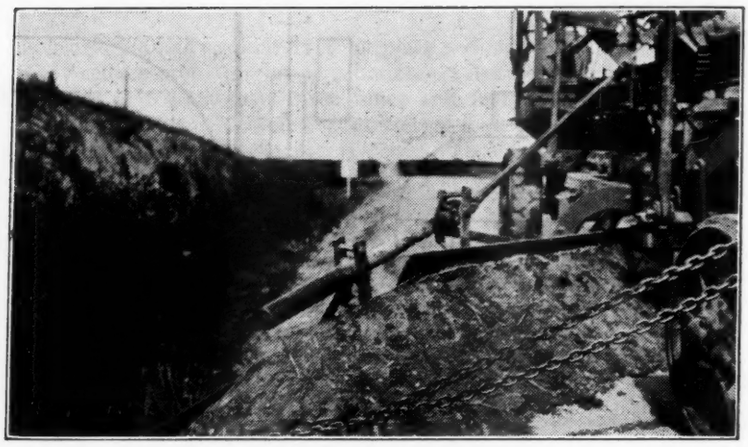
Factors in different localities vary, and each intersection should be studied and the most advantageous radius selected.

The above is slightly condensed from a bulletin issued by the American Road Builders Ass'n and credited by it to Mr. Lefferts.

Ingenious Device Recovers Gravel Surfacing

When loose gravel is bladed into a windrow over close to the shoulder of the road, some of it gets down over the edge where it cannot be reached with the patrol grader. Traffic also throws a certain amount of the gravel over the shoulders and rains wash some away also. On many miles of gravel roads this loss represents a large sum of money in the course of a comparatively short time.

When the side slopes are dry and not too steep or slippery, the surfacing material can be scraped up with a blade to the top of the side slopes, but some



Recovering gravel surfacing material.

always rolls back and it is a slow and expensive job to recover it. A ragged shoulder line is apt to be the result.

This loss was one of the perplexing little problems that confronted the North Dakota maintenance department until Harris Robinson, assistant division engineer in charge of maintenance in the Bismarck Division, devised the following plan:

A portion of an old blade was hinged to the end of the regular blade on the grader by means of a heavy bolt. This section of blade can readily be adjusted to fit any slope, and held rigidly to the desired side slope. The angle at which it cuts is controlled from the operator's platform by means of a hand wheel on a tumbling rod attached to a screw-type lifting mechanism taken from an Austin Western power patrol.

The gravel is cleaned from the side slopes and brought up so that the regular blade can get it and carry it onto the roadway. A clean workmanlike job is done with one trip of the machine. This little device looks simple and is simple to make and operate, but it does the work. Many yards of gravel that have gone over the shoulders can be brought back cheaply and neatly. If this machine salvages only 100 cubic yards of gravel per mile and we have about 5,000 miles of gravel, that would make 500,000 cubic yards of gravel saved. Being worth at least a dollar per cubic yard this device is certainly worth something to the taxpayers who pay for the building and maintaining of roads.

The above item appeared in a recent issue of the North Dakota Highway Bulletin.

Development of New Mexico's Road Oil Formula

THE New Mexico Highway Department has developed an empirical formula for computing the quantity of oil most effective in treating a given road, based upon the sizes of particles composing the surface. This formula is:

$P = .02\,a + .07\,b + .15\,c + .20d$

In which P = percentage weight of oil required, on basis of total weight of bone dry untreated aggregates;

a = percentage by weight of dry material above the 48-mesh sieve (equivalent to Government 50-mesh. The maximum size aggregate in New Mexico passes a 1″ round opening).

b = percentage by weight of dry material passing 48-mesh and retained on 100-mesh;

c = percentage by weight of dry material passing the 100-mesh and retained on the 200-mesh.

d = percentage by weight of dry material passing the 200-mesh.

The development of this formula is described in the department's bulletin by L. C. Campbell, materials engineer, in a humorous article which unfortunately is too long to be reproduced entire but from which we quote a few paragraphs.

This formula "is almost purely empirical, and took a whole lot more aspirin, lava soap and corn cobs to finally produce it than pencil lead. It is based on the general theory that, within reasonably narrow limits, there is only about one amount of oil that will produce the tightest bond and greatest spirit of cooperation between the particles of a given material and cause them to turn out the tightest and most stable mat. The problem before us was to produce a formula that was simple, requiring the minimum amount of prerequisite tests, could be used rapid fire on short notice or no notice at all in the field, and yet above all things be dependable and accurate, well within the limits of the field facilities to match its degree of refinement."

Consideration was given to the fact that different soil materials differ in their specific gravities, absorptive powers, surface areas, surface characteristics, oil-holding capacities, shapes, and areas of contact; while oils differ in their specific gravities and in viscosities, which means film thicknesses on a given particle at a given temperature. The oil will be applied at temperatures ranging between approximately 140° and 200° F., while those of the mat will range from around 10° in winter to 130° in summer.

How to get the proper factors and the proper values all marshalled into a dependable formula devoid of Greek letters and crossword puzzles led to additional doses (of aspirin). (By crossword puzzles I mean things that would so puzzle the field man as to entice him into making a good old Irish speech about the laboratory.) By the time it came to doping out how the field man could make all the prerequisites and get the answer in time for the contractor to do any work that day and not find any mistakes after supper, I was completely numb and did not need any more aspirin. And so "far into the night" many kilowatt hours passed; "then came the dawn."

Everything has limits (with the possible exception of time and taxes); in the case of the materials involved, the specifications provide upper and or lower limits. We began to suspicion that probably there was a fair average between those limits and the general level of materials produced and available; that between extremes of conditions there was a good general prevailing average; that the possible extremes within acceptable limits would not depart radically from a rationally determined average; that the probable variation therefrom would be much less; and that practically all such variations would still be within a degree of refinement not obtainable in the field. So we started out on that track, not knowing where it would lead us. Samples of acceptable surfacing materials naturally accumulated in the laboratory from all

over the state; that were finally composited into a "state average" of acceptable material involving the lowest acceptable grade, the best the state produced, and all grades in between. There is not a radical difference between these two extremes of quality within acceptable limits, but even so it permits the economic use of a surprising amount of local material.

We separated the "state average" sample into its respective sizes by careful wash analysis in order that no material between any two screens contain other sizes. Minus 200 was collected by dry screening more of the same material rather than by recovery from wash analysis. To the quantities of each size of material thus obtained we began to add known percentages of oil varying from obviously too little to obviously too much. Percentage of oil added was always by weight of the unoiled "bone dry" aggregate. At this point let us back up a bit and advise that average "acceptable" oil was used.

Series of specimens were made, of the several sizes, and broken. All conditions of time, temperature and manipulation were closely controlled and made as nearly the same as possible. (So far as we know, even the status of the Eighteenth Amendment remained about the same throughout the determination.) The specimens were all broken about two weeks after moulding to allow a little time for loss of lights, absorption, etc. The results on various sizes were averaged up and as I recall, results, *if any*, departing more than 10 per cent from the average were discarded; the remaining results reaveraged, the process repeated until the extremes were within 10 per cent of the average. From these results we picked the percentage of oil associated with the best ones and seated it in its proper place in the formula.

This process seemed to work fine until we got up into particles coarser than the 48. These particles were too coarse to mould specimens out of, so we were up a stump with long roots on it. It seemed like there were a lot of promising things we could *not* do but what we *could* do did not show up right away. After another trip to the drug store and trying various things, the diameter of a sphere having an averaging between that of a 1" and 48 mesh particle was figured and a quantity of material passing the nearest size sieve above and retained on the nearest size sieve below that opening selected. We took a relatively large quantity of minus 48 material—figured the percent oil required for it; took a small quantity of the "average size material," mixed it with the percent oil required for the minus 48 material, then mixed the minus 48 material in with the oiled "average size" material; mixed it and mixed it thoroughly (the hands make a most excellent pug mill for laboratory size samples). Screened out the "average size" particles as best we could over a screen a size smaller than the lower average screen, and weighed a sample of the residue, extracted the oil and weighed the sizes recovered. Knowing the amount of oil used and the weight of the sizes recovered we could figure how much oil the "average size" particles appropriated to themselves, which we surmised would be probably a little less than what they should have, as the effect of the mixing was for them to rob the smaller particles; so the percentage on basis of untreated weight of the particles in question was rounded off upward to the next per cent. This may not have been good theory but it seemed to be satisfactory practice. This resulted in a formula giving a slightly less amount of oil than the present form. After some field and laboratory trials with it, the considerations arising therefrom lead to its rounding off upward to its present values making it still a little simpler, a little less refined, but at the same time providing more nearly the optimum amount of oil.

That is about the size of it. The formula is certainly a cross breed of various methods and tactics; it . . . is subject to a great deal of criticism from an academic standpoint, but with all its vulnerability it seems to possess one rather peculiar characteristic in addition to its Spartan simplicity and ease of application, and that is, it works quite satisfactorily for our conditions and materials, which is the purpose for which it was intended.

A very few times in its lifetime of some four years it did not do its stuff very well, but in each case the material was either unusually absorbent or unusually non-absorbent. In such cases, which are very rare, we get around this difficulty by making a series of trial mats with the particular material in question, using varying amounts of oil, and select the percentage that results in the best mat. If there are two or three such trial mats giving substantially the same stability, we use the higher percent oil for practical reasons.

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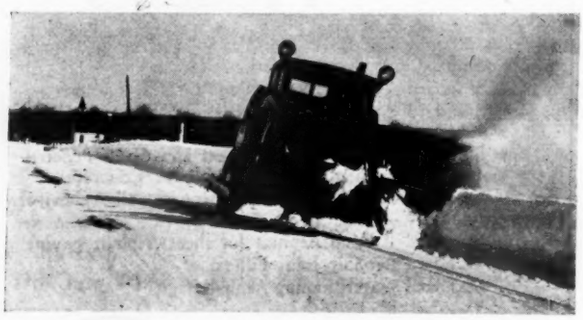
Equipment for Snow Removal in Michigan

By B. C. Tiney
Maintenance Engineer, Michigan State Highway Department

WITH an average annual snow-fall varying from 30 inches in the southern part of the State of Michigan to 130 inches in the northern part, a number of types of equipment are necessary to meet the different conditions efficiently and



Widening a cleared road, using rotary plow mounted on ten-ton tractor. Road had been opened previously by V plows on motor trucks.

economically. In selecting equipment for snow removal consideration should also be given to the suitability of the motorized units for use on other maintenance or construction work during the balance of the year.

Blade Plows—In the southern half of the Lower Peninsula of Michigan, the great majority of storms are handled with one-way blade plows, mounted on motor trucks. These plows are 10′ wide and 3′ high and are equipped with spring tripping devices to ride over obstructions. This type leaves the roadway in clean and smooth condition and its use is being extended into the northern part of the state to supplement the work of the heavier V-plows. The fact that the blade plow functions full width on the return trip makes it the most efficient type for snow up to the depth it is capable of handling. Hitches have been developed which make it quickly interchangeable with the V-plow.

Another type of blade, capable of removing deeper snow, has come into popular use in the past two years. This plow has a rigid hitch, which is attached off center to reduce the side thrust and has a flaring mold-board. When operated at a speed of 20 to 25 miles per hour, the snow is thrown well out from the roadway. It is regarded as intermediate between the spring-blade and the V-plow but cannot be operated as close to the road surface as the spring-blade.

Truck V-Plow—For a great deal of the work in the northern part of Michigan and for the heavier storms in the southern part the truck V-plow is used. This type is 8 or 9 feet wide, 3 to 5 feet high. It will remove much deeper snow than the blade and is very useful in widening work. While we purchase it without wings, our organization has in many cases constructed a supplementary wing about 2½ by 14 feet in size mounted on the right side just behind the truck cab. This wing is raised and lowered by a hand hoist (in a few instances by power hoists) and is very effective in pushing back the top part of a high bank. The wing may be so constructed as to be reversed and pull the top of the bank down into the roadway, where it is thrown out by a rotary plow which follows.

The truck V-plows are of various shapes. The so-called speed plow is of very stream-line design and when operated at a speed of 25 to 30 miles per hour will throw the snow to a considerable distance and minimize the formation of high banks. Traffic conditions will not permit safe operation at this speed in all parts of the State and this design of plow must be operated at high speed to be effective. Plows with steeper rise than the speed type are considered better for widening and general purpose plowing in traffic.

Truck Rotary Plows are being used to advantage in the northern area. They are effective in widening work, throwing the snow well back to avoid the forming of high banks. Of particular value is their speed, as compared with tractors, in traveling to distant sections of drifted roadway.

Trucks used by the Michigan State Highway Department for snow removal work are of two general classes:—

3½ tons capacity, minimum H.P. 40—SAE rating.
4½ to 5 tons capacity, minimum H.P. 48—SAE rating.

General specifications are as follows:—

Six cylinder motor; air cleaner and oil filter; seven speed transmission; minimum wheel-base 160 inches; electric lights and starter; front lights on cab brackets to permit use with plows installed; three-man, full door, closed winter cab; automatic double windshield wiper; rear view mirror; single pneumatic tires.

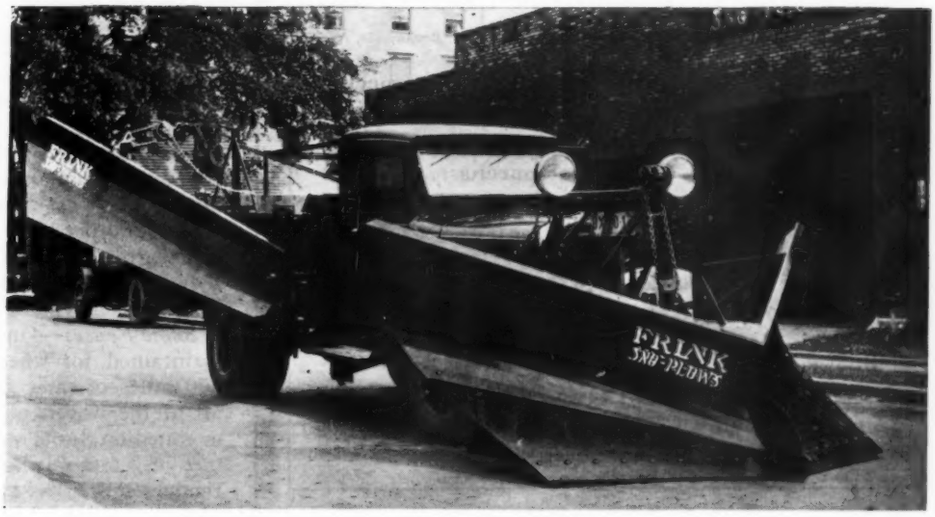
If dump body is specified, it is 3½ cu. yd. capacity with horizontal hydraulic hoist. Recent trucks have been equipped with balloon instead of high-pressure tires. Adequate brakes are important. Practically all of the trucks purchased by the State have been of the two-wheel drive type, but quite a number of our county road commissions, performing maintenance work for the State under contract, are using four-wheel drive trucks. These are advantageous in extremely heavy snow removal work and tend to minimize tractor plowing. We believe it to be desirable to have, in each county organization, one or two extra powerful trucks for emergency work, and these might well be of the four-wheel drive type.

Drift Control

Drift control is a factor which has made possible the more extensive use of lighter and faster-moving snow equipment, which in turn has resulted in more continuously open roads.

One-way blade plow on motor truck operated at 25 miles per hour in Ionia County. Note distance to which snow is thrown.

FRINK SNO-PLOWS



Model 48S Sno-Plow and Model 10R Leveling Wing attached to a 3-Ton Motor Truck

THE answer to the snow removal problem simmers down to well defined facts which are governed by the answers to the following questions: 1. What type of motive power is available for snow removal work? 2. From what type of roads is snow to be removed? 3. What are the average and maximum depths of snow which will have to be removed? 4. What is the mileage of roads from which snow will be removed? ¶ FRINK Sno-Plows are adaptable to a greater variety of the above conditions than any other snow plow because there is a greater variety of sizes from which to select and because they are designed by one of the pioneers in the manufacture of snow removal equipment, after years of experience and intensive study of all kinds of snow conditions from the Arctic regions of northern Canada to the southern limits of the snow belt in the United States.

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Our design engineer gives a great deal of consideration to securing the maximum snow protection. Wide right-of-way, eight-foot shoulders, and 4 on 1 ditch slopes help the snow problem; while in flat, open country the finished grade is laid at least 1½ feet above the adjacent fields to prevent drifting on the roadway. This modern cross-section tends toward a substantial reduction in snow removal costs.

Through the remaining wooded territory of northern Michigan the State has, for several years, been purchasing 400-foot timber strips adjacent to the trunk line highways, for both snow protection and roadside beauty. A total of 65 miles of roadside timber has been acquired to date, of which 22½ miles was donated. The average cost per mile of that purchased was $2280.

In the flat, open sections of the northern part of the State, 200-foot right-of-way is secured and pine seedlings are planted in rows on the outer edge of the right-of-way. The planting is in five rows, which are three feet apart, using a total of 5000 seedlings per mile on each side of the road. An equivalent of 169 miles of planting on both sides has been done during the past three years, at an average cost of about $200 per mile. Our forester estimates that eight years' growth will give these trees a height of about 7 feet, which should provide an effective permanent snow barrier.

Snow Fences—On 7920 miles of trunk line highway maintained for wheel traffic, we have approximately 600 miles of snow fence in place. This is practically all of the woven picket type, 4 feet in height. It is mounted on 8-foot steel posts, and is raised to a height of 6 or 7 feet during the winter if the height of drifts renders this necessary. When erected in the fall it is placed about 6 inches clear of the ground, largely to prevent the base of the pickets from freezing into the ground and interfering with raising. The fence is attached to the posts by wire ties with looped ends which are handled quickly by a special twisting tool.

In general, the fence is placed from 75 to 125 feet from the center line of the road, depending upon local conditions. A study of drift conditions is made each winter by the maintenance superintendent, who usually keeps some notes to govern the location of fence for the following year. On wide right-of-way the fence may be located on the property line and left there permanently. On narrow right-of-way the fence is located on private property, with the owner's permission. The State has never established the precedent of paying local residents for this privilege, but has, in general, had excellent co-operation from them.

Our Research Division has, for several years, been studying the formation of drifts and action of winds around fences of different kinds and heights. An experimental snow fence station is maintained for this purpose.

We estimate the annual cost of snow fence per lineal foot as follows:—

Annual rental	$0.01¼
Erection	0.02
Dismantling	0.02
Total	$0.05¼

To this must be added the cost of raising, if necessary. A continuous mile of snow fence on one side of the road would then cost about $277 per year, plus raising cost. While the placing of snow fence at critical locations no doubt pays large dividends in money saved and road service given the public, we believe

it possible to use too much snow fence and thereby increase the cost of the work. The economical dead line must be determined by careful study and observation.

The average annual cost of wheel traffic snow removal on the State highway system of Michigan for the past nine years has been $69.50.

Icy Roads—The treatment of icy roadways to decrease the traffic hazard is a matter of increasing concern to maintenance organizations. Sand, or preferably fine cinders if obtainable, are stockpiled in the fall at locations convenient to the sections to be treated. About 25 to 50 pounds of calcium chloride per cu. yd. is mixed with the material in the stockpile to prevent freezing. At the time of application, additional calcium chloride, in flake form, at not to exceed 50 pounds per cu. yd. is mixed with the material. Application is made by mechanical spreaders. Treatment has been confined to hills, curves, approaches to railroad crossings, road intersections or other critical points. The flake calcium chloride causes a quick thawing of the surface of the ice, which embeds and holds the sand. The cost of sanding has previously been included with snow removal, but last winter it was charged separately to obtain cost information, as we believe it forms a very appreciable item in some parts of the State.

Purchasing Highway Equipment for Counties

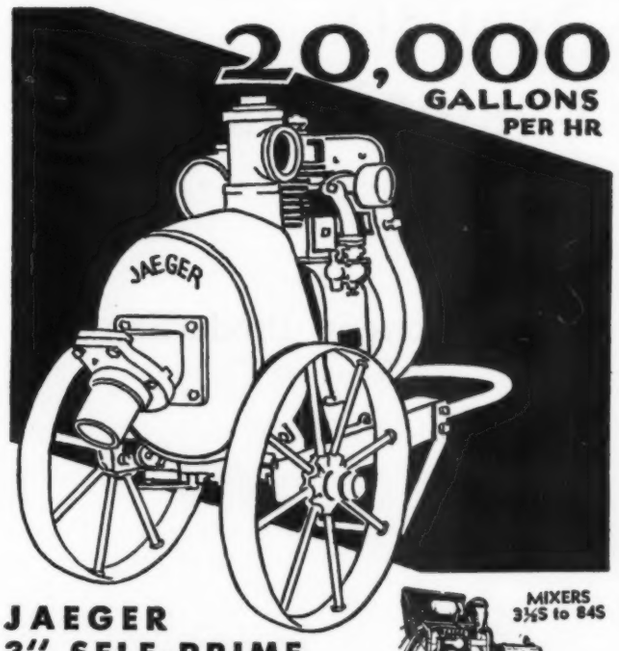
Important recommendations in regard to the purchase of highway equipment for counties have recently been made by a committee of the American Road Builders' Association. Among the sound and important practices recommended by this committee are:

That the county purchases be made directly by the county and that the decision as to the choice of equipment rest with the county engineer or the county highway superintendent. That, in purchasing equipment, the determining factor shall not be first cost alone, but that the following elements be considered, with suggested relative weights as indicated.

(a) 100 Your own past experience with similar machines.
(b) 70 Performance record of equipment.
(c) 68 Mechanical details of equipment.
(d) 66 Materials used in equipment.
(e) 64 Efficiency in repair parts service.
(f) 62 Experience of others with similar machines.
(g) 60 First cost of equipment.
(h) 58 Location of and service rendered by local distributors or agents.
(i) 52 Price of repair parts.
(j) 42 Past performance of bidder.
(k) 40 Length of time products have been on market.
(l) 32 Capacity of plant and ability to make prompt deliveries.
(m) 30 Financial standing.
(n) 26 Number of similar machines manufactured and sold.

That counties maintain service and cost records on each piece of equipment, and that exchange and comparison of such records be encouraged. That "trade-in" allowances on new equipment tend to obscure actual prices and values. And that bids on equipment requirements be received early and the orders therefor, when practicable, be placed in January just following the Road Show, thus helping to level the seasonal production curve.

The personnel of the committee follows: W. O. Washington, chairman; Stanley Abel, W. W. Brandon, D. M. Campbell, Will M. Clark, E. C. Gwillim, Howard B. Keasbey, B. C. McCurdy, H. McGraw, J. C. McLean, C. H. Overman and Chas. E. Grubb.



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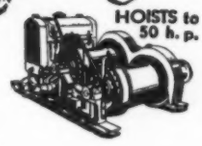

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Variations in Production of Sewage Gas

By Henry W. Taylor

THE writer has seen many extreme flows of gas under conditions of violent activity in sludge digestion tanks, and has been curious as to the relation between the maximum, average, and minimum flows under normal conditions. A three-day test was run at the plant at Rome, N. Y., by the local superintendent in October, 1932, half-hourly readings being taken throughout this period.

The figures for each day seemed to group themselves into three distinct periods—the operating period, from 8 A. M. to 4:30 P. M.; quiescent period, from 4:30 P. M. to 2 A. M.; and the mordant period, from 2 A. M. to 8 A. M. The readings were grouped by these periods for each of the three days, and the three sets of figures for each period were averaged. These averages are shown in table No. 1.

Table No. 1—Average Rate of Flow of Gas from Digestion Tank

Based on records (half-hourly readings) of a three-day run at Rome, N. Y. in October, 1932. Normal activity in digestion tank.

	Average Percentage (100% = average of 3-day totals)		
Period	*Maximum*	*Mean*	*Minimum*
8 A. M. to 4:30 P. M.	125	95	79
4:30 P. M. to 2 A. M.	115	106	99
2 A. M. to 8 A. M.	109	95	81

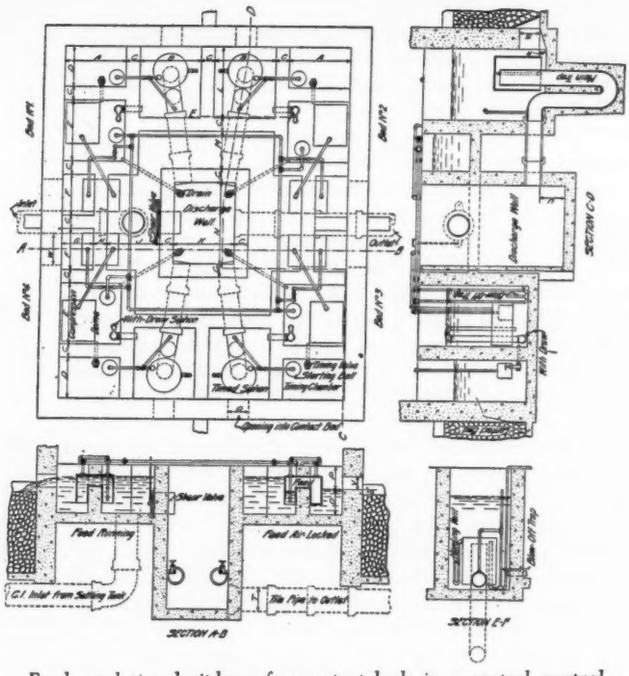
Table No. 2 gives quantities and relations for the absolute maximum and minimum; estimates being made for quantities which, during periods of great activity, exceeded the capacity of the piping and accessories and consequently were not registered, by assuming that the same relations between the average and the corresponding maximum and minimum applied during great activity as during normal. It is the opinion of this office that the ratio is as great and is probably even exceeded in the case of the maximums.

Table No. 2—Maximum and Minimum Gas Flows

During three-day run of digestion tank at Rome, N. Y. With estimates for other periods and other plants. Estimated figures are in parentheses.

Description	*Cubic feet per day*	*Percent of average daily*	*Cubic feet per Capita per day*
Three-day run at Rome			
Maximum	27,000	140	1.0
Average daily total	19,370	100	0.72
Minimum	13,900	72	0.52
Peak activity at Rome in July			
Maximum rate	(40,000)*	(140)	(1.5)
Daily total	29,000	100	1.07
Minimum rate	(21,000)	(72)	(0.77)
Peak activity at Saranac Lake in July			
Maximum rate	(21,000)*	(140)	(1.92)
Daily total	15,000	100	1.37
Minimum rate	(10,800)	(72)	(0.99)

*Maximum rates caused blowing of seals during height of activity.



Feeds and timed siphons for contact beds in a central control house. *See Page 20.*

We have contended that piping and accessories for handling gas should be designed for a maximum rate of flow of 2 cu. ft. per capita per day, and this appears to be substantiated by the Saranac Lake figures. The most uniform gas production occurs after the operators stop agitating the plant and between 4:30 P. M. and 2 A. M., after which the production consistently subsides, probably due to lower night temperature and a need for another period of agitation.

Ferric Chloride Notes

In view of the interest recently being taken in the use of ferric chloride in water and sewage treatment, the following brief summary of the most important characteristics of that material (for which we are indebted to the Dow Chemical Company) may be appreciated by many of our readers.

The commercially available forms are 36% to 45% solutions, and the crystal grade contains approximately 60% anhydrous Fe Cl_3. The freezing point of the solution decreases in almost a straight line from 32° at zero solution to —66° for a 32% solution. The solubility varies from —10° for a 36% solution to 58° for a 45% solution, and about 100° for a 60% solution. It is therefore desirable to ship solutions of weaker concentrations in cold weather, while in summer economy in freight charges can be made by shipping more concentrated solutions.

The simplest method of determining the strength of a ferric chloride solution is by measuring its specific gravity. Ten degrees Baume corresponds to 8% Fe Cl_3; 20° to 17.5%; 30° to 27.5% 40° to 37.5%; 50° to 48%; and 60° to 59%.

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¶ It is older than tradition and as hot as the place Mohammed said was reserved for unbelievers.

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¶ They finished the first of five new Layne wells. A Layne pump was spouting clean, cool, pure water that came from a thousand feet below the desert.

¶ Selim Ben Yahya, who had led camel caravans across the desert more times than there were hairs in the beard of the Prophet, tasted the water.

¶ His grin spread until it threatened to engulf his own white beard.

* **"WATER OF HEAVEN!" he said.**

¶ "What do you mean—'water of heaven?' " one of the engineers asked him.

¶ "Did not Mohammed himself say that heaven is a place of sweet water?" Selim explained.

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for 40%-45% solutions is approximately $10 to $15 a ton.

"Solutions can be stored indefinitely. They are acid in reaction and are commercially handled in either rubber-lined steel or in acid-proof brick-lined concrete tanks. Rubber-lined pipe or ordinary hose and acid-proof pumps are used for the conveyance of the solutions. Such equipment has been found to have long life and has given very satisfactory service." (See also below.)

On page 35 of our October issue the statement is made: "A difficulty in the handling of this proportioning problem lies in the corrosive character of ferric chloride, for which no resistant metal or alloy has been developed for commercial use." Referring to this, the Duriron Company, Inc., writes us: "We invite your attention to the fact that Duriron is so slightly affected by this corrosive when the temperatures are those of the surrounding atmosphere as to make it suitable. It is available in the form of valves, pumps, pipe and many other shapes, one form being a variable-stroke pump which can be operated through a variable-speed drive to give an extremely accurate proportioning."

Beautification of Sewage Treatment Works Sites

(Continued from page 10)

roads or paths intersecting the front of the grounds.

Shrubs are a wonderful addition to the appearance when planted about the administration or main building and are advisable to surround the parking grounds and blank corners. Shrub hedges are advisable and almost a necessity about, and some six to ten feet back from, the outside walls of settling or Imhoff tanks when the tops of these tanks are at or near the elevation of the surrounding grounds. This serves the two fold purpose of concealing from open view the plain tanks with their seldom pretty contents and forms a safety barrier to visitors. About tank structures whose top extends some height above the grounds, earth should be placed having a slope about that of a railroad fill and be planted with shrubs of nature and extent which will, within a very few years time, completely cover the banks. Seeding or sodding such banks with grass is neither successful nor satisfactory, for if heavy rains and frost do not ruin them repeatedly (and both do so in this state) the work of weeding, cutting and maintaining them in decent appearance is burdensome. In front of the shrubbery about the administration building and along the side of the main entering footpath or bisecting road, beds of low perennial flowers add greatly to the beauty of the site. A screen or background along the sides and back of the grounds and around open sludge beds is desirable. High shrubs or even perennials, if the extent makes the cost of shrubs prohibitive, will accomplish this mission. This planting conceals unfavorable appearing surroundings, defines the sites and also furnishes the feeling of seclusion which appeals to the sense of privacy and individuality.

Types of Vegetation Adaptable for Use on Grounds

Almost any type of tree, shrub or perennial flower which is native to or will thrive in the locality is adapted for use on the grounds, so it is not necessary or desirable to provide either rare or foreign vegetations. For high shrubbery, privet, honeysuckle, spirea, weigelia, golden elderberry or even the common native elderberry. For low hedges and for banks, barberry, snowberry, corralberry. Around the main building, hydrangea, flowering quince, almond, forsythia, etc. Next to the walls of glass-covered sludge beds, where low walls are the rule, thick growing perennials such as the common variety of day lillies or iris are excellent. For screens along the sides and back of the grounds, if shrubs are not possible, use hollyhocks, golden glow, common elderberry or similar high-growing plants. In our beds about the main building we have iris, delphinium, poppies, cannas and fall chrysanthemums. We find a delight, as do our visitors, in a solid row of zinnias and asters along the front of the hedges which face the entrance view, these two being the only annuals we have tried so far that are easily grown and furnish a profusion of beautiful colors in the fall.

It is not necessary to employ a landscape architect to draw up the plans for the site in a small community. The engineer in charge can make up the grading and road layout and local nurserymen will be glad to advise and assist without fee on the layout and type of vegetation best adapted for the place and, if at all honest, be better at the job in so far as costs and planting are concerned since it will be a conspicuous advertisement for them.

Many of the flowering perennials can be secured by donations from the citizens of the community at times when they are thinning out their private gardens. All we have—and they are many—were obtained in this manner.

Reasonable Minimum and Maximum Limits of Extent and Cost

In my opinion the minimum extent in landscaping the site consists of well shaped grading, plain grass lawns, and trees about the boundaries, the cost of which would be about ½% of the cost of the treatment works. Further landscaping can, if wanted, be made to any degree those in charge may desire, but an extreme can be reached in this just as in any other matter. It is not advisable nor in good taste to attempt to elaborate to the extent found on a private estate. Enough to dress the structures and grounds in pleasing but not extravagant harmony, with a dash of bright color scattered here and there, screens to conceal the unsightly areas, and open lawns at the front and sides of the structures, is fully sufficient and can be accomplished at not to exceed 1½ to 2% of the cost of the works.

The above paper was presented at the Pennsylvania Institute of Urban Problems, State College, Pa., July 28, 1932.

The R. F. C., Self-Liquidation and Assessments

A month ago, as stated in our November issue, we were informed by the R. F. C. that it did not consider front foot assessments as taxation, and that they could be included as a part of self-liquidating revenues in applying for aid. Two weeks later the legal staff of the Corporation announced that such assessments *are* taxation of "the most obnoxious form" and can not be so included, in spite of the fact that several awards have already been made including them.

This Gordian knot can be untied only in the historic way—cut it by congressional action deleting the taxation limitation from the law. And do it immediately. Thousands who might have been aided by use of R. F. C. funds have already passed many unnecessary weeks in unemployment.

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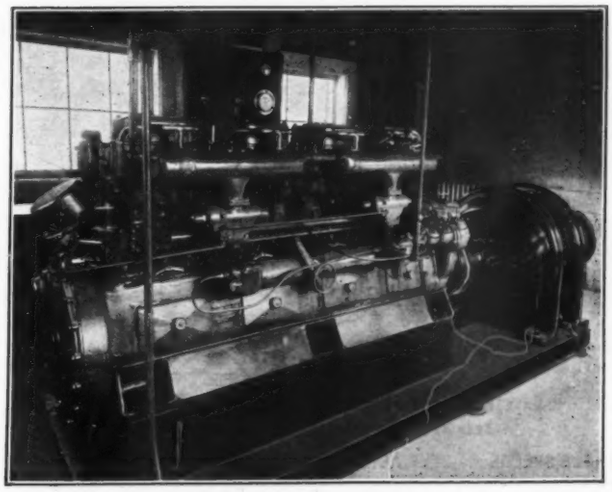

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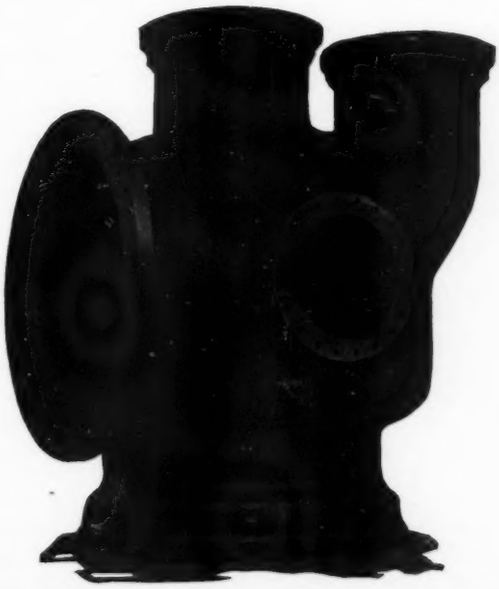

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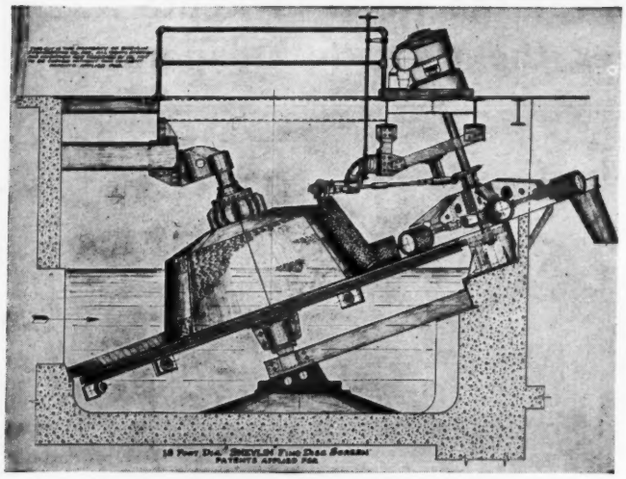

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Sludge Pumping Experiences

By D. Y. McDowell

Superintendent of Water Works, Malvern, Ark.

MALVERN, Arkansas, a town of a few over five thousand population, has had considerable trouble in the past removing the sludge from two sewage treatment tanks. They *have* had such trouble, but no more will they be bothered in this way.

One of these tanks was an Imhoff tank designed to take care of about eighteen hundred population. It did its work well until the prosperous years, just previous to the depression, during which time building expansion and sewer extensions increased the load to about twenty-five hundred population. Immediately this tank acquired a severe case of halitosis, and its best friends would not go near it, much less tell it about its trouble.

As in most towns of Malvern's size, the sewer system is part of the worries of the water department, so the superintendent's troubles increased. He tried to pump the sludge with a three-inch ditch pump, but of course this choked up so often that he could get nowhere, and he abandoned this for a small centrifugal water pump, with no better results. He then set up a gin pole and a bull wheel operated by an old Ford motor, and used a valve-bottom dipper made of an old ice freezing can which held about 36 gallons. With this improvised apparatus he finally succeeded in emptying the tank of its entire contents—sludge, raw sewage and everything.

In 1930 another superintendent was appointed by the newly elected city council. He tried the last plan of the former superintendent, but soon became discouraged and called on one of the members of the water and sewer committee of the council (who is of a mechanical turn of mind) and they tried still another device in the form of an endless chain with conveyor buckets attached, but this too was a failure, and they shut down the work and called into consultation a pump engineer of Fairbanks, Morse and Company, who recommended and guaranteed their four-inch Wood trash pump to do the job.

When the pump arrived it was set up and a three-inch suction hose was attached with a four-to-three-inch reducing bushing, and to the discharge side of the pump was attached a four-inch pipe. The pump was then placed by the side of the man-hole into which the Imhoff tank siphons the sludge, and was belted to an old Fordson tractor for a power plant. The tractor was cranked, and the problem quickly ceased to be how to get the sludge out of the tank but became one of where to store it. Towels, socks, rags, rocks, and ru- other various and sundry unmentionables came through the pump as though they were clear water.

The old tractor proved to be an unsatisfactory power plant, and other kinds of power were tried and found wanting. (Electric power is not available at the tank sites.) Recently an old automobile was bought and the pump swung into the frame just ahead of the rear axle housing, and directly connected to the motor with a universal joint attached to the pump shaft and the shortended propeller shaft of the automobile. This furnishes ample power, which is always ready for service, and the arrangement has the added advantage of having the pump mounted on wheels for ease in moving from place to place, so it can be used not only as a sludge pump, but for pumping water as well.

Complete Metering of a Sewage Treatment Plant.

In preparing for efficient operation, the new activated sludge plant of the Easterly Sewage Treatment Works of Cleveland, Ohio, designed by George B. Gascoigne, probably equals if it does not exceed all other modern treatment plants in its use of meters for measuring and recording quantitatively each process of the operation.

Indicating, recording and integrating register, Easterly sewage treatment works.

The raw sewage enters the mixing channels through four 72-inch meters, and is mixed with return sludge which has passed through four 24-inch meters. The air for the aeration tanks is measured through sixteen 20-inch meters, one for each pair of tanks. The aerated sewage passes through sixteen 36-inch meters and the excess sludge through four 8-inch meters.

The forty-four sewage and sludge meters are all venturi tubes provided with Bailey sewage meter registers of the indicating, recording and integrating float-operated type, the charts and integrators being driven by a Warren synchronous motor-driven clock.

The air meters also are venturi tubes with Bailey air meter registers of the indicating, recording and integrating type employing oil-sealed belt-operated mechanisms.

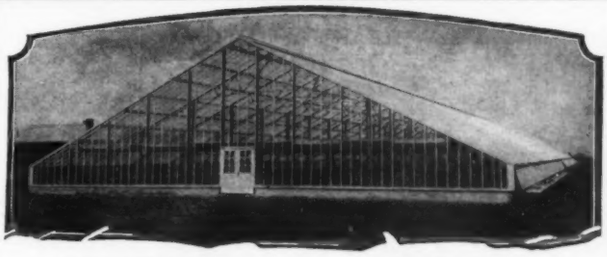
With these meters measuring the sewage, activated sludge and air entering each tank and the effluent and sludge leaving it, the superintendent will have a continuous reliable record of operation which, combined with the chemical, bacteriological and physical analyses of all influents and effluents, will give the complete story of the operation of the plant.

One Hour Maximum Water Consumption

The 1932 report of the water department of Holland, Mich., states that, although the city has four sources of water supply, all are required simultaneously to meet the peak load. All these are ground water supplies, cold and clear, with an average hardness of 267 p.p.m. Says the report: "To maintain normal pressure during the peak loads of the season required the use of the million-gallon concrete reservoir located at the Fifth Street station. The yield from the various stations and the reservoir at the time of the maximum peak load was as follows:

28th St. Station	1,050 G.P.M.
19th St. Station	1,475 G.P.M.
8th St. Station No. 1	1,075 G.P.M.
8th St. Station No. 2	1,140 G.P.M.
Reservoir	1,027 G.P.M.
Total	5,767 G.P.M.

"This delivery for one hour is equivalent to a rate of 8,304,480 gallons per day, which is approximately double the actual pumpage on the maximum day, or 5.8 times the average daily pumpage for the year, which was 1,425,097 gallons."



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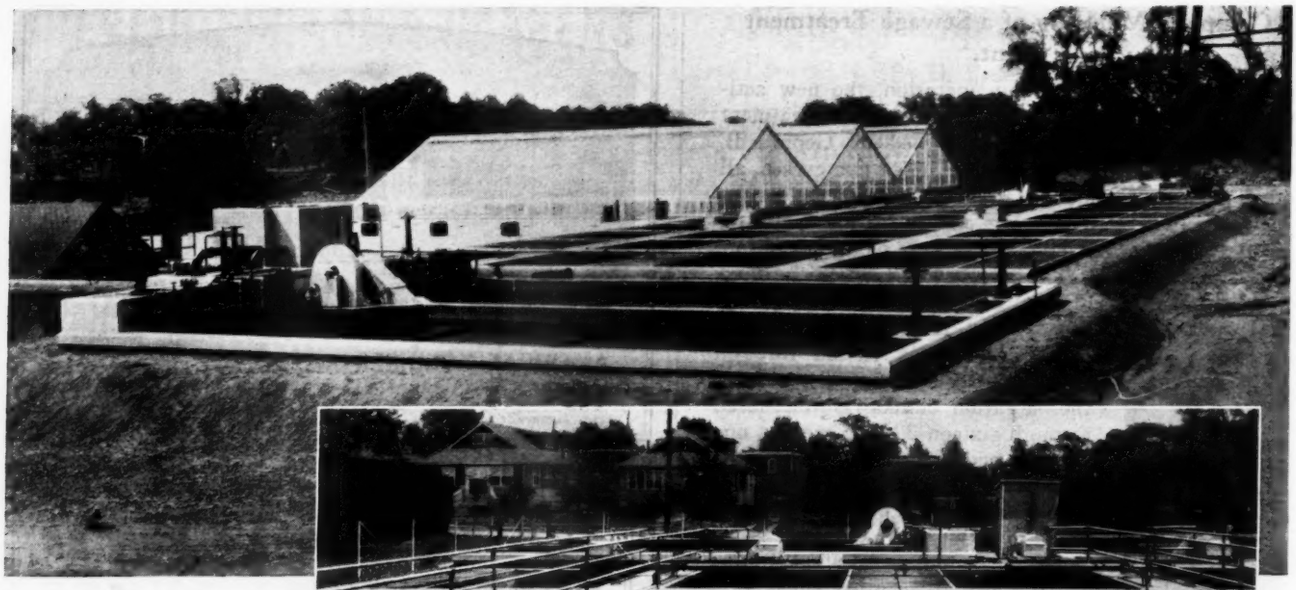

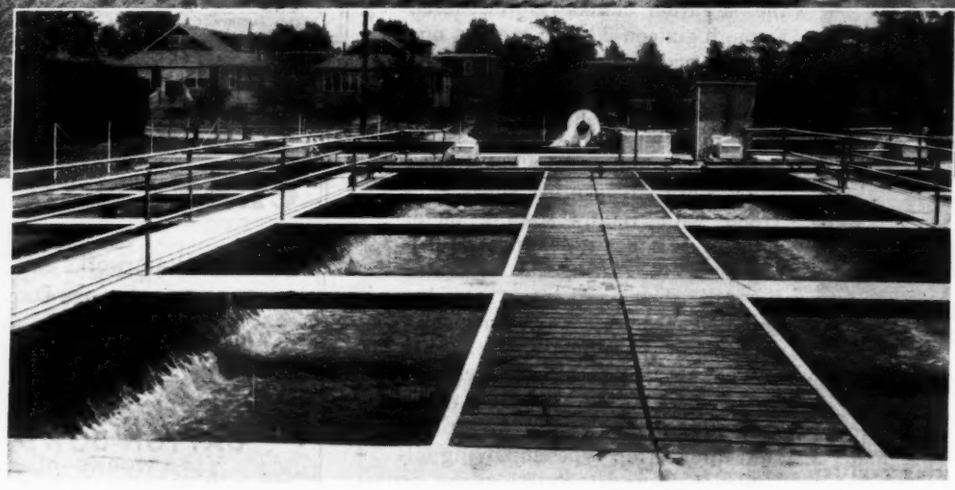

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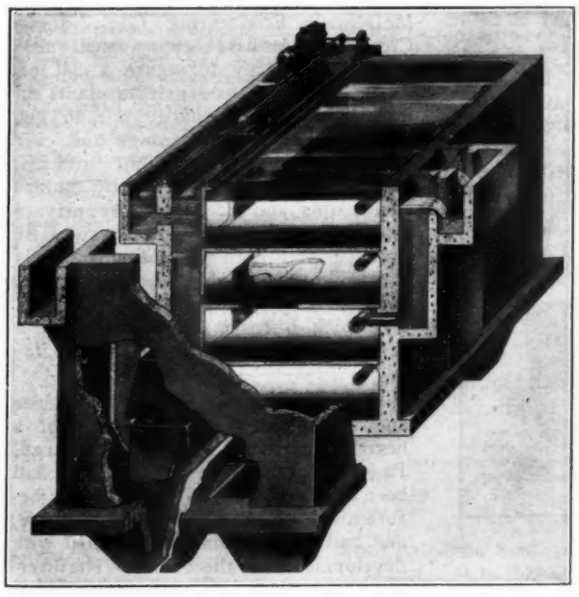
A Tray Type Clarifier for Sewage Treatment

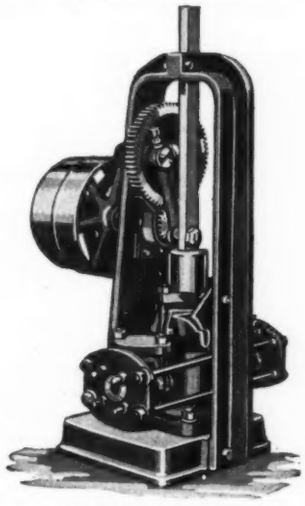
To effect continuous rapid separation of solids in sewage treatment and the immediate removal of clarified effluent, the Pacific Flush Tank Co., Chicago, Ill., has designed a tray type clarifier. The construction details are shown in the phantom illustration herewith. Many advantages are claimed, one of the most important being the very great density of sludge. Others include a permissible high velocity of flow, with detention time reduced about two-thirds and a considerable saving in cost.



Pacific Flush Tank Tray Type Clarifier

A Pump for Handling Ferric Chloride

In a recent issue it was stated that there was no resistant metal or alloy developed for commercial use in handling ferric chloride. The Duriron Co., Inc., Dayton, Ohio, states that Duriron does successfully handle ferric chloride, and that their 215DA pump is especially designed for handling such chemicals. This pump has an adjustable stroke mechanism, so that the stroke can be adjusted from zero to four inches, thus allowing the feed to be controlled. All parts contacting with the liquid to be handled are of Duriron. A description of this pump is contained in Bulletin 167, which, with fuller information on the handling of ferric chloride, will be sent upon request to the Duriron Co., Dayton, Ohio, or to PUBLIC WORKS.



The Duriron Pump

New Sizes of Cameron Motorpump

A number of new sizes have been added to the Cameron line of small general service centrifugal motorpumps manufactured by Ingersoll-Rand Company, 11 Broadway, New York City. These pumps are now made in one-inch discharge and upward. Pump and motor are assembled as a single unit with a common shaft. The discharge nozzle may be turned to any one of four positions. No baseplate is needed.

Fig. 1. Bailey Fluid Meter

New Bailey Fluid Meters

For the measurement of steam, water, gases, and other fluids, the Bailey Meter Company, Cleveland, Ohio., have announced a new line of meters. Three general combinations are available: indicating and integrating; recording and integrating; indicating, recording, and integrating. Fig. 1 illustrates the recording and integrating fluid meter, which is best suited to the majority of installations. The record is made in pounds per hour, gallons per minute or any other desired units on a 12″ diameter, 24-hour chart. Accurate analysis of the record is equally easy throughout the entire flow range since the flow graduations are uniformly spaced. This feature also greatly facilitates comparison with records of pressure and temperature which may be obtained on the same chart, when desired, by incorporating auxiliary recorders in the flow meter casing. The total flow is given in pounds, gallons or other units by a 6-unit counter which is located behind a small window in the meter name plate.

Controlling Corrosion

A chemical formula has been developed for controlling corrosion and eliminating scale and rust from hot water lines and heaters which is unique in its action and composition. This material does not coat the piping but controls corrosion by attacking the fundamental causes. It combines directly with oxygen forming a stable compound and thus removes oxygen as a factor in corrosion. Carbon dioxide is adsorbed on the surface of the colloid while scale forming particles are maintained as suspensoids. The material is easily adjusted for pH.

The base formula frequently requires no adjustments, has a pH of about 5.5, less than 2% mineral matter, reduces Fehling's solution, combines with lime, is partially volatile and equally suited for boiler and hot water treatment.

This product is being introduced by D. W. Haering & Co., water consultants, 565 W. Washington Blvd., Chicago, Ill., and is marketed under the registered trade mark "H-O-H."

Industrial and Technical News

The Four Wheel Drive Auto Co., Clintonville, Wisc., have put into effect a 5-day week plan, thus affording work to an additional man for every ten men now working. Though the plant is not now running at capacity, there has been an increase in the volume of business during the past few months.

The Sterling Engine Co., Buffalo, N. Y., will exhibit at the Power Show, Grand Central Palace, N. Y., December 5 to 10, a Sterling Petrel engine of 1200 RPM, 116 HP, direct connected to a 45 KW GE generator. This power unit is intended for the Menands Bridge at Troy, and is a duplicate of the unit being installed on the Albany-Rensselaer Bridge. This engine incorporates the latest features, including twin carburetors and dual ignition.

The Marmon-Herrington Co. has delivered to the Indiana State Highway Department three all-wheel drive trucks, equipped with 3-yard dump bodies, which will be used for highway maintenance and snow removal.

Ingersoll-Rand Co., 11 Broadway, N. Y., has acquired exclusive rights for SKF drill steel and will handle it under the trade name IR-SKF.

Brookville Locomotive Co., Brookville, Pa., have announced the use of Caterpillar engines for their 6 to 12-ton size locomotives.

U. S. Pipe and Foundry Co. announce the removal of their eastern sales office to the Lincoln-Liberty Bldg., Philadelphia, Pa.

Roots-Connersville-Wilbraham, Connersville, Ind., announce that their New York office is now located at 24 State St. D. L. Dowling is district manager.

George M. Sharer has been appointed sales manager of the eastern division, Link-Belt Co., with headquarters in Philadelphia.

Marmon-Herrington Co., Indianapolis, announce two new distributors for their all-wheel drive trucks: Associated Equipment Co., Ltd., San Francisco, Calif., and R. L. Harrison Co., Inc., Albuquerque, N. M.

Catalogs Received:

The Speeder Machinery Co., Cedar Rapids, Iowa, manufacturers of shovels, cranes and draglines, have issued a new catalog describing the ½-yard B-3 Speeder. The catalog will be sent on request.

Bucyrus-Erie Co., So. Milwaukee, Wisc., have issued a bulletin describing the new 16-B, ½-yard dragline, shovel, clam, dragshovel and skimmer. Copies of the bulletin are available on request.

Caterpillar "20" tractor is described fully in one of the typically interesting booklets of 40 pages just issued by the Caterpillar Tractor Co., Peoria, Ill. Sent on request.

Caterpillar Trailer Patrol for road and ditch maintenance is illustrated and described in a recent folder of the Caterpillar Tractor Co., Peoria, Ill.

Snow Removal Methods and Equipment: A recent publication by the Caterpillar Tractor Co., Peoria, Ill. Sent on request. This company also issues a sheet describing their snow plow for auto patrols.

The Sargent-Cletrac Snow Plow is described in a folder just issued, and now available on request from the Cleveland Tractor Co., Cleveland, O.

Monarch Snow Plows are described in a leaflet put out by the Monarch Mfg. Co., Inc., Wilmington, Del. Though a new product, these reversible blade snow plows for motor truck attachment have found a ready acceptance, and two heavy-duty plows have been delivered to the Bureau of Public Roads for work in Colorado. Literature will be sent on request.

The Tuthill Highway Guard, recently announced by the Tuthill Spring Company, 760 Polk Street, Chicago, Illinois, is described in a new folder recently issued by that company.

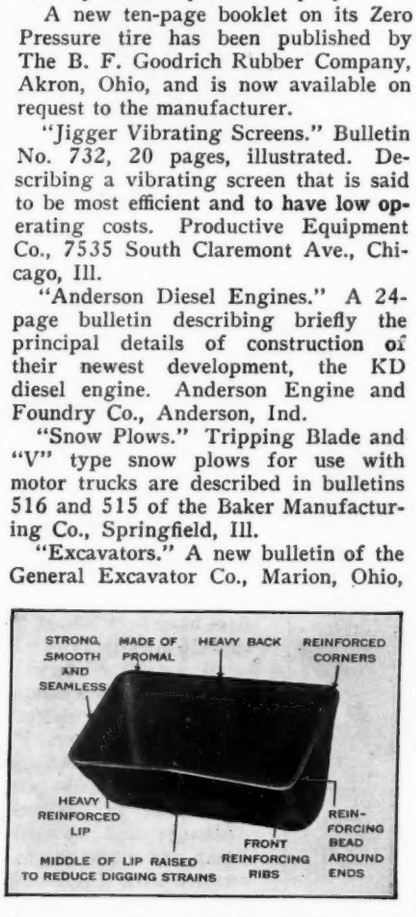
A new ten-page booklet on its Zero Pressure tire has been published by The B. F. Goodrich Rubber Company, Akron, Ohio, and is now available on request to the manufacturer.

"Jigger Vibrating Screens." Bulletin No. 732, 20 pages, illustrated. Describing a vibrating screen that is said to be most efficient and to have low operating costs. Productive Equipment Co., 7535 South Claremont Ave., Chicago, Ill.

"Anderson Diesel Engines." A 24-page bulletin describing briefly the principal details of construction of their newest development, the KD diesel engine. Anderson Engine and Foundry Co., Anderson, Ind.

"Snow Plows." Tripping Blade and "V" type snow plows for use with motor trucks are described in bulletins 516 and 515 of the Baker Manufacturing Co., Springfield, Ill.

"Excavators." A new bulletin of the General Excavator Co., Marion, Ohio, showing the complete line of equipment made by this company. Ask for Bulletin 3210.



A new type elevator bucket has been announced by Link-Belt Co., Chicago. It is known as the AAP, and is made in various sizes.

Meters, Pumps & Engines.—Worthington Pump and Machinery Corp., Harrison, N. J., have recently issued catalogs on: Gas engines, S-550-S4; water meters, W-900-B12; centrifugal pumps arranged for automatic priming, W-323-B1; drainage and irrigation pumps, D-450-S12; deep well pumps, D-450-S9, S10 and S11; sump pump, D-450-S2A.

Snow Removal.—A new bulletin by Caterpillar Tractor Co., Peoria, Ill.

A bulletin, recently issued by Bucyrus-Erie Company of South Milwaukee, Wisconsin, describes their new Red Arch Dragline Buckets (Type X). Liberally illustrated, it fully describes the many newly introduced features which give increased output and lower operating costs to dragline owners.

The complete range of sizes (from ½ to 8-yards) is listed with weights and complete dimensions. Readers may write the manufacturer direct for copies, mentioning PUBLIC WORKS.

"Rock Drills and Sharpeners" is the title of a 32-page illustrated condensed catalogue whch consolidates in one volume essential information concerning Ingersoll-Rand equipment for drilling rock and for reconditioning drill steels. In addition to describing the various rock drills, including "Calyx" core drills, the booklet covers all accessory equipment and also contains instructions for correctly heat treating drill steels. Copies of the catalogue, Form 4101, may be obtained from the general offices of Ingersoll-Rand Company, 11 Broadway, New York, or from any of the company's branch offices.

Rates, Revenues and Results of Municipal Ownership of Water Works in the United States

This booklet of 60 pages has been compiled and published by Burns & McDonnell Engineering Co., Kansas City, Mo. It has been no small task for this company to secure a list of all the municipal and private plants of each state, and a difficult one to get the rates, revenues, earnings and cost of water. Averages for 250 cities are given—225 of them served by municipal plants and 25 served by private plants—covering the average costs of water delivered to the consumer. This and other data equally interesting and valuable will be found in this booklet, for which Burns & McDonnell make a charge of $1—and it is well worth it.

Morris Knowles, sanitary engineer and city planner, died suddenly of a heart attack at his home in Pittsburgh, Pa., on November 8. Mr. Knowles had been at his desk in his office the day before his death. He was 63 years of age, and had been intimately connected with developments in the sanitary engineering field since his graduation from M. I. T. in 1891.

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★ *It is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company, Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Explosives

74. "Use of Explosives for Settling Highway Fills." A new booklet which fully explains by diagrams and charts the three methods developed after many tests by the Du Pont engineers, which singly or in combination will quickly and efficiently do your job. Just issued by E. I. Du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.

Graders

76. Latest information about Galion Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Galion Iron Works & Mfg. Co., c-o The Jeffrey Mfg. Co., Columbus, Ohio.

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1248, 1298 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

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12-32

108. "Keeping Trucks in Condition for Keeping the Highways Open," a comprehensive, 32-page, illustrated booklet containing much valuable information on the proper care of snow removal equipment to prolong its life. Issued by Dept. B, the Four Wheel Drive Auto Co., Clintonville, Wis.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave, Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac. McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 385 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines. 910 S. Mich. Ave.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

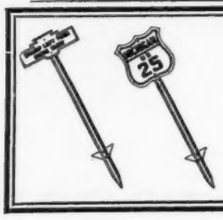
Highway Maintenance

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.



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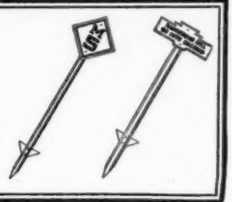
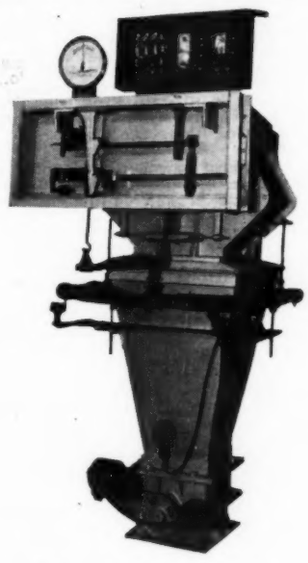


Sweet's Steel Company, Williamsport, Penna.

Highway Equipment and Materials

Fuller Automatic Weighing Batcher

This automatic weighing batcher meets the specifications of highway departments. The batcher cannot be discharged if the batch is not within the allowed tolerance of over or under weight. Discharge may be controlled to prevent loss



Fuller Weighing Batcher

by splashing out of truck containers, and the discharge gate cannot be closed, nor the feeder started until the hopper is completely empty. This control pays for itself in protection against loss due to overweight and speed in batching. The Fuller Co., Catasauqua, Pa., are the manufacturers.

Lufkin Hi-way Drag Tape

This is a new Steel Tape, extra sturdy and designed especially for highway, railroad and other heavy

The Lufkin Hi-Way Tape.

work. It is made by The Lufkin Rule Co., Saginaw, Michigan, manufacturers of Measuring Tapes, Rules and Precision Tools.

This 5/16 inch wide Chain Tape is of special tough steel, of extra weight, practically unbreakable. It has etched graduations, with black lines and figures and "Nubian" finish. The markings and figures are prominent and deeply cut into bright high portions of the line itself. These markings will remain clear even after much dragging of the tape.

New Tuthill Highway Guard

When an automobile strikes a Tuthill guard, the bumper action of the spring rail support immediately deflects the car back onto the road with a minimum, if any, damage. The guard rail is placed at the proper height to receive the impact from bumpers, hub caps, wheels, or running boards, thereby eliminating damage to the car body or fenders.

It consists of the usual anchoring posts with a special ¼" x 10" spring steel, convex shaped, rail guard, mounted securely with ½" bolts to a 7/16" x 4" tempered spring steel support.

Complete information will be sent to anyone addressing the Tuthill Spring Company, 760 West Polk St., Chicago, Ill.

Mixing Cold Patch Material

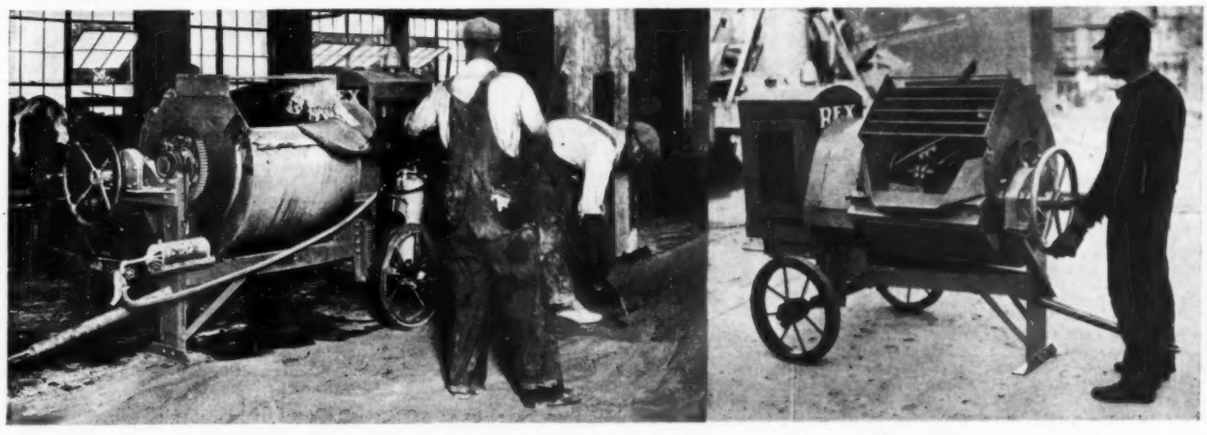
The Chain Belt Co., Milwaukee, Wis., has developed a Cold Patch Mixer for all sorts of patch work. This mixing unit is mounted on a two-wheel, rubber-tired, spring mounted trailer type truck, so that it can be hooked be-

Air compressors are now available for all model Cletracs, with capacities from 120 cu. ft. for the model 15 up to 640 cu. ft. for the model 80. Above is shown the "35" with 320-ft. Davey air compressor. Compressors are easily dismounted, but in many types of work the mounting is economical and desirable.

hind the maintenance truck and towed from job to job at reasonably high speed. The power is supplied by an 8 H.P., 2 cylinder engine. The drum capacity of this machine is four to six cubic feet, and the mixing time varies from 30 seconds to 1 minute, depending upon the nature of the materials used. The paddles are of high carbon steel with hardened steel scrapers that can be adjusted to compensate for wear. The overall length of the machine is 80 inches, width 53 inches, height 57 inches, and weight approximately 1,390 lbs.

In addition to being used for patch work on highways, this machine is now also in use for side-walks, tennis courts, and playgrounds. Among such users are the Milwaukee Park Board who are using it quite extensively for either emulsified or cut-back asphalts in both asphaltic concrete and fine texture mixes. In this work it has been demonstrated that in the coarser mixtures the mixing is extremely rapid and in all mixtures, both fine and coarse, the particles of mineral aggregate were all uniformly coated with bitumen.

The machine is equipped with a heating device under the drum which promotes a better mixing of the aggregates. This heater is unusually valuable as a time saver in winter when the constituents of the mix are abnormally hard.



The new Chain Belt Cold Patch Mixer. At left, in operation in Milwaukee.

Road and Paving Materials

Bituminous Materials

227. "Asphalt for Every Purpose a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n, National Press Building, Washington, D. C.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with 'Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

Snow Fences

346. "The Snow Removal Problem," by W. A. Olen, Pres. and Gen. Mgr., F. W. D. Auto Co., Clintonville, Wis., is a brief booklet which should interest all who are faced with the problem of snow removal. Contains suggestions for improving the efficiency of equipment, etc.

347. "Control Winter Drifts"—A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Joliet, Ill. Illustrated in two colors.

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activated Carbon, Aqua NUCHAR

380. For low cost removal of tastes and odors from potable waters. Used by more than 300 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

407. New "Handbook of deLavaud Centrifugally Cast Iron Pipe" contains useful information for the water works man including revised specifications together with dimensions and weights of deLavaud pipe in accordance with Federal Specifications for Pipe; Water, Cast-Iron (Bell and Spigot) N. WW-P-421. Just issued by the U. S. Pipe and Foundry Co., Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps, Self-Priming

416. "Make your present pumps self-priming." Bulletin No. 530 B describing the Hazleton Suction Line Primer which can be applied to old as well as new pumps regardless of make. Issued by Barrett, Haentjens & Co., Hazleton, Pa.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

419. An illustrated booklet showing installations, and complete details regarding the 19 exclusive improvements which are featured in Shevlin Fine Disc Screens will be sent promptly by the Shevlin Engineering Co., Inc., 227 Fulton St., New York, N. Y.

420. A useful new bulletin for all those interested in sewage disposal, describing some of their proven equipment such as self-cleaning bar screens, grit conveyors, sludge collectors and shredders, has just been issued by the Jeffrey Mfg. Co., Columbus, Ohio. Includes diagrams and many illustrations.

Screens

424. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Treatment

430. Separate bulletins showing their many lines of sewage treatment equipment will be sent promptly by The Pacific Flush Tank Co., Chicago and New York. The latest is No. 110 describing tray clarifiers.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., Peoria, Ill.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125. Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Transits and Levels

629. A booklet giving full information on the sizes and styles of Berger Transits and Levels will be sent promptly by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co. 136 No. 12th St. Philadelphia, Pa.

Wire Rope

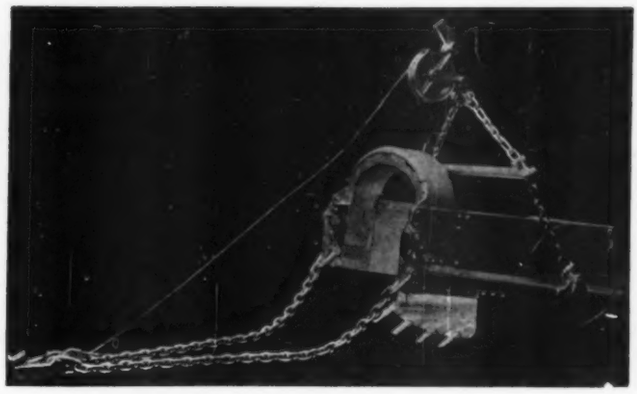
634. Williamsport Wire Rope Co., Chicago, Ill., has issued a folder illustrating their new method of "preseating."

A Pneumatic Tractor Tire

Development of a pneumatic tire for tractor service, a companion to the Zero Pressure, is announced by The B. F. Goodrich Company, Akron, Ohio. Known as the Tractor-Grader tire, the new Goodrich product is of the lug-type. Tread design is self cleaning, constructed to give clean, positive sharp-edged gear wheel traction. The herring-bone design insures straight forward motion and does not allow side-creep.

The specially compounded, very thick tread resists the abrasion and cutting of sharp stones common to tractor service. Special consideration was given to the destructive qualities of road oils and tar, resulting in a tread compounded to do an outstanding job in building and maintaining tar-bound roads.

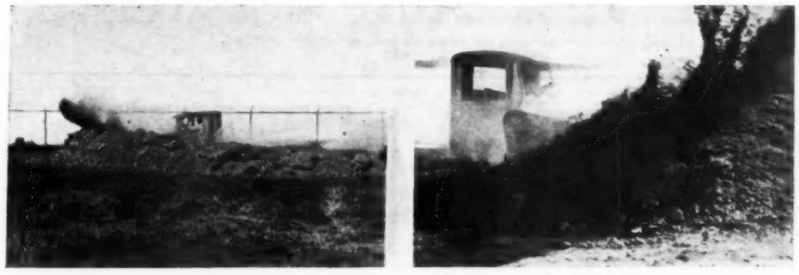
Goodrich Tire.



"D L" Type Williams Dragline Bucket

Testing Snow Plows in Summer

On a 500-ft. runway, ending in a solid clay bank, an FWD truck, equipped with standard "V" snow plow, was tested to determine its adaptability for such rugged work. The truck was driven into the bank at 20 to 25 miles per hour, all wheels driving under a fully open throttle. Over a period of several months, 1208 impacts were made without a single mechanical failure of the truck, though the plow was wrecked on numerous occasions. This was to be expected, since there were 200 pound stones in the bank.



Testing FWD Truck and Snow Plow in Clay Bank

For All-Year Road Making

The John Deere-Van Brunt Road Maker is especially adapted to the application of sand, ashes, cinders and calcium chloride because of its simple operation and even distribution—requirements of first importance. It distributes the material evenly its full width of 8 feet. It is easy to operate and easy to fill. It has a positive feed action and a positive quantity control. It can be used with horses, or hitched behind a motor truck or horse-drawn truck. A supply of surfacing material can be carried in the truck and shoveled directly into the distributor box while the outfit moves along.

This machine is manufactured by Deere & Co., Moline, Ill.

For Bigger Dragline Output

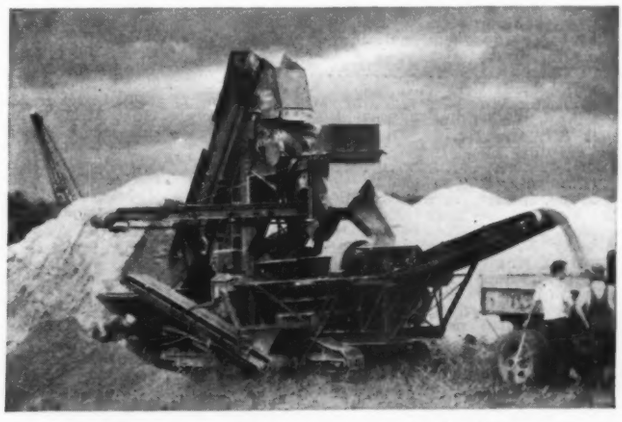
The Wellman Engineering Company, Cleveland, Ohio, has developed an improved type "DL" Williams Dragline Bucket not only to withstand the severe service on levee construction but incorporating many outstanding improvements greatly appreciated by the users of this type of equipment. These buckets are now built in sizes ranging from 1¼ to 3 cubic yards rated capacity.

New Barber-Greene Portable Screening and Crushing Plant

With many specifications now calling for sized gravel and also demanding a certain percentage of crushed material, the Barber-Greene Company, Aurora, Illinois, announces a new crushing plant designed to work in conjunction with a standard B-G Bucket Loader with vibrating screen. These two units form a complete excavating, screening, crushing and loading plant that is self propelled and portable, and consequently can still take advantage of the short truck hauls by utilizing the local pits, changing the source of supply as often as necessary.

The plant can work directly into the bank or into the stockpile, and the entire machine moves forward as the material is excavated. Only one operator is required. Although the capacity of this type of plant is variable, being dependent on the percentage of fines, oversize and required size in the bank, this plant has proven its ability to handle from forty to fifty cubic yards per hour under normal conditions of sized material delivered to the trucks.

John Deere-Van Brunt All-Year Road Maker



Barber-Greene Portable Screening and Crushing Plant

Index to Advertisements

Adelphia Hotel 51
Alvord, Burdick & Howson ... 41
American Moninger Greenhouse Mfg. Corp. 39
Atlas Mineral Prod. Co. 42

Babcock Brothers 41
Barrett Co., The ..... Front Cover
Barstow & McCurdy 41
Berger & Sons, C. L. 32
Black & Veatch 41
Buffalo-Springfield Roller Co. 6
Burns & McDonnell Eng. Co. 41

Caird, James M. 41
Calcium Chloride Assn. 3
Cast Iron Pipe Research Asso. Back Cover
Caterpillar Tractor Co. 2
Cleveland, H. Burdett 41
Columbia Alkali Corp. 3
Cramer, Robert 41

Dayton-Dowd Co., Inc. 39
Dow, A. W. 3
Dow Chemical Co. 3
du Pont de Nemours & Co., Inc., E. I. ..... 4 and 5

Farasey, J. D., Mfg. Co. 6
Frink, Mfr., Carl 31
Fuller & Everett 41
Fuller & McClintock 41

General Excavator Co. 33

Harnischfeger Corp. 6
Hill, Nicholas S., Jr. 41
Hitchings & Co. 42

Jaeger Machine Co. 33

Layne & Bowler 35
Link-Belt Co. 40
Littleford Bros. Co. 6
Lynchburg Foundry Co. 37

Metcalf & Eddy 41
Michigan Alkali Co. 3
Mohawk Asphalt Heater Co. .. 33

Pacific Flush Tank Co. 39
Pearse, Greely & Hansen 41
Piccadilly Hotel 51
Pirnie, Malcolm 41
Potter, Alexander 42

Roberts Filter Mfg. Co. 39
Robinson & Steinman 42

Shevlin Engineering Co. 38
Simplex Valve & Meter Co. ... 38
Solvay Sales Corp. 3
South Bend Foundry Co. 42
Standard Oil Co. of Ind. 8
Standard Oil Co. of N. Y. ... 29
Sterling Engine Co. 37
Sterling Motor Truck Co. 32
Sweets Steel Co. 46

Taylor, Henry W. 42

Williamsport Wire Rope Co. .. 29
Woodstock Hotel 51

When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 45 and order by number.

Official Advertising

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N.Y., until one o'clock p. m. on Tuesday, December 6th, 1932, for the construction of highways in the following counties:

	Deposit Required
NASSAU ..... (Parking Fields, Entrance Drives, Sidewalks and Miscellaneous Items)	$8,000.00
QUEENS	8,500.00
QUEENS ..... (Bit. Mac. Mixed in Place, 0.20 mile, & Bridges, Parking Fields, Access Roads, Bridle Paths, Foot Paths & Misc. Items)	16,000.00
	2,800.00
SUFFOLK	13,000.00
	11,000.00
(Preliminary, 0.22 mi.; Grading 4.54; & Structures, 2.60)	
SULLIVAN ..... (Bit. Mac. Pen. Method; Type 2, 4.09 miles)	13,000.00
Also for the reconstruction of the following:	
CATTARAUGUS	4,500.00
CATTARAUGUS ..... (8 Bridges & Bit. Mac. M. M. 3 App., 0.64 miles & 4 Bridges & Bit. Mac. M. M. Opt. Appr. 1.05 miles.)	5,000.00
DELAWARE ..... (Concrete, 3.79 miles)	14,000.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. No Refund will be made on plans, proposal forms or specifications. The addresses of the District Engineers and counties in each district will be furnished upon request. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center Sts., New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

A. W. BRANT,
Commissioner of Highways.

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N.Y., until one o'clock p. m. on Tuesday, December 20th, 1932, for the construction of highways in the following counties:

	Deposit Required
QUEENS ..... (Slope Protection)	$3,800.00
Queens ..... (Comfort Stations, Gas Stations, Police Booth)	4,000.00
SULLIVAN ..... (Viaduct, 10-76.5' Girders & 3-61.5' Girders, B.M.P. Type 2 & Appr., 0.56 mile)	10,000.00
Also for the reconstruction of the following:	
CATTARAUGUS (also elimination) ..... (B.M.P. Type 2: M.M. 3, 7.05 miles)	$18,000.00
CATTARAUGUS (also elimination) ..... (B. M. P. Type 2 M. M. 3 7.05 miles)	$18,000.00
GENESEE (Con. & Recons.).... (Concrete 2.45 miles)	14,000.00
JEFFERSON ..... (30' I-Beam; 8x10 Box; 10x10 Box; M.M.O. Appr. 0.61 miles) (Concrete 4.46 miles)	2,800.00 11,000.00
ROCKLAND (Con. & Recons.).. (Concrete 6.85 miles)	22,000.00
TIOGA (Cons. & Recons.)..... (5—190' Trusses; 2—85' Girder Appr. Spans; Bit. Mac. Type 3: & Concrete, 0.57 mile)	15,000.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose districts the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and counties in each district will be furnished upon request. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center Sts., New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

The contract advertised above for construction and reconstruction in Rockland County is an Employment Relief Project. The minimum rate for unskilled labor on this contract shall be from forty cents to fifty cents per hour, as specified in the contract, and the minimum rate for skilled labor shall be fifty cents to sixty cents per hour, as specified in the contract. Veterans of the U. S. Military Service with dependents, where qualified to do the work, shall be given preference in employment. No person, except those in supervisory, executive or administrative positions, shall be employed for more than thirty hours in any week. Details of these regulations with respect to preference in employment, use of hand labor, hours of employment, etc., will be found in the itemized proposal.

A. W. BRANDT,
Commissioner of Highways.

TREASURY DEPARTMENT, office of the Supervising Architect, Washington, D. C., December 1, 1932. Sealed bids, in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p. m., January 12, 1933, for furnishing all labor and materials and performing all work for the construction (except elevators), main building, etc., U. S., narcotic farm, at Lexington, Ky. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 4, 1931 (Public No. 798). Drawings and specifications, not exceeding six sets, may be obtained at this office in the discretion of the supervising architect by any satisfactory general contractor, and provided a deposit of $50.00 is made for each set to assure its prompt return. One set will be furnished builders' exchanges, chambers of commerce or other organizations who will guarantee to make them available for any sub-contractor or material firm interested, and to quantity surveyors, provided a deposit of $50.00 is made to assure its prompt return. Checks offered as deposits must be made payable to the order of the Treasurer of the United States. Cash deposits will not be accepted. JAMES A. WETMORE, Acting Supervising Architect.

Printed by WNU, New York

DEC 12 1932

PUBLIC WORKS

CITY COUNTY STATE

Battleground Road, near Lafayette, Ind. Tarvia-treated gravel.

HIGHWAY officials are inevitably attracted by the sound economy of Tarvia maintenance. It offers a simple, effective and inexpensive means of protecting the tremendous highway investment in existing macadam and gravel roads. Applied on gravel or old macadam, Tarvia actually penetrates the road and cements together the stone and fine particles, thus providing effective resistance to the disintegrating effect of traffic. This economical Tarvia treatment transforms gravel or macadam roads into durable, easy-riding highways with non-skid surfaces which will not wave, roll or rut.

Whatever your road problem—new construction, repair or maintenance—the Tarvia field man is at your service with practical advice founded upon actual experience. 'Phone, wire or write our nearest office.

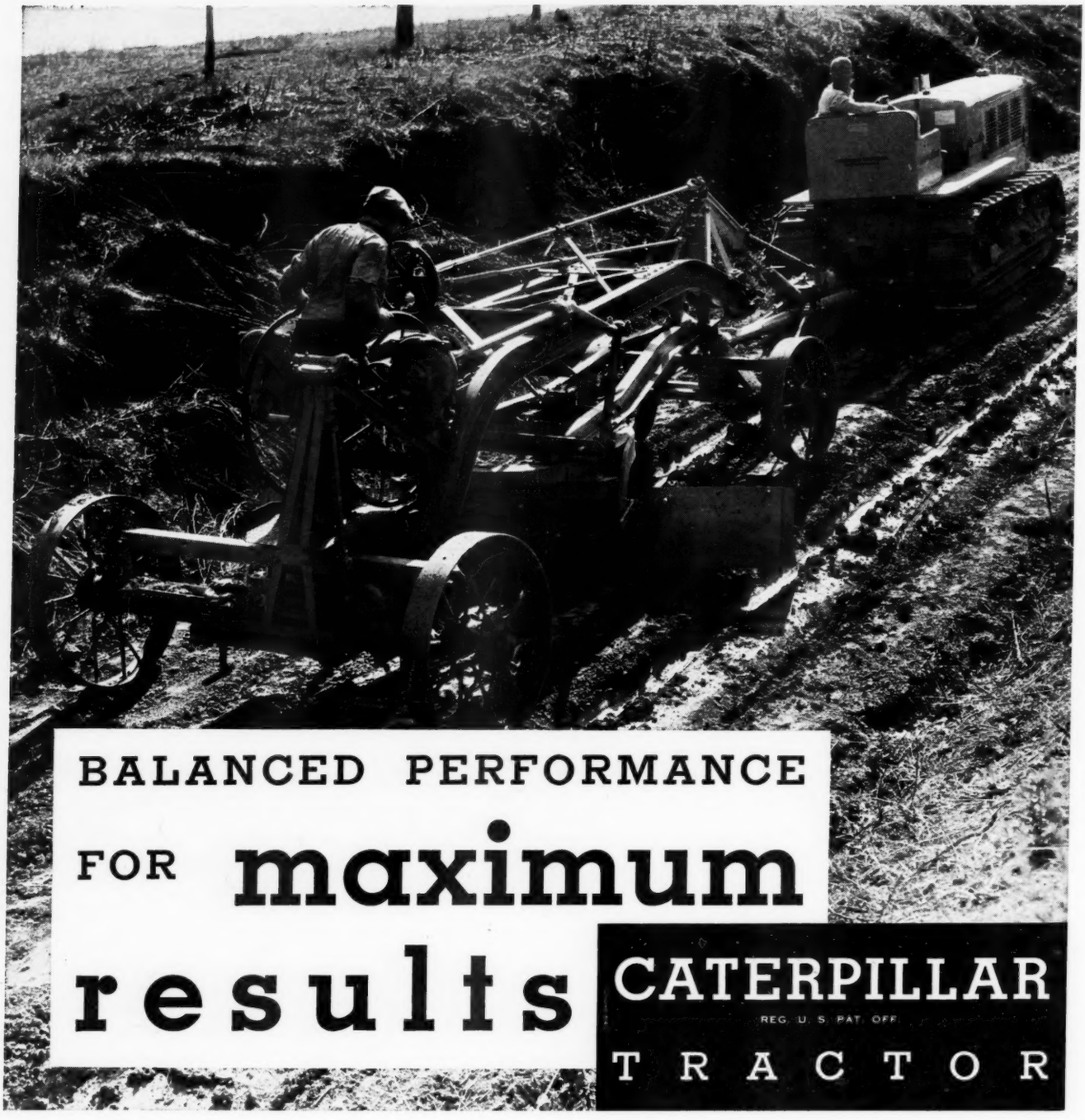
The Barrett Company

New York, Chicago, Philadelphia
St. Louis, Minneapolis, Hartford
Detroit, Cleveland, Boston
Buffalo, Columbus, Milwaukee
Providence, Syracuse, Birmingham
Lebanon, Toledo, Cincinnati
Baltimore, Youngstown, Bethlehem
Rochester, Portland, Me.

THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Tarvia
GOOD ROADS at LOW COST

DECEMBER, 1932



BALANCED PERFORMANCE FOR maximum results

CATERPILLAR
REG. U. S. PAT. OFF.
TRACTOR

THIS "Caterpillar" Thirty-Five Tractor and Grader begin their duty of putting — and keeping — 59 miles of dirt road in tip-top condition. And an Illinois Township's levy drops with a thud that even a deaf taxpayer can hear!

For each size of "Caterpillar" Tractor, there's a correct size of "Caterpillar" Grader — built to match each other in strength and stamina. Designed to utilize most effectively the ample power developed by the rugged engine and the gripping traction of broad tracks. Offered teamed together to triumphantly fulfil the "Caterpillar" pledge: The Most Miles of Road for the Fewest Taxpayers' Dollars.

Your "Caterpillar" dealer will gladly give you complete information on "Caterpillar" Tractors, Graders (Blade and Elevating) and the "Caterpillar" Auto Patrol.

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Track-type Tractors Road Machinery
Combines

(There's a "Caterpillar" Dealer Near You)

●

Prices — f. o. b. Peoria, Illinois

FIFTEEN . . .	$1100	THIRTY-FIVE .	$2400
TWENTY . . .	$1450	FIFTY	$3675
TWENTY-FIVE .	$1900	SIXTY-FIVE . .	$3850
DIESEL	$6500		

VOL. 63 No. 12
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DECEMBER, 1932

Mr. Highway Official- this might be your CHILD

ICE CONTROL with CALCIUM CHLORIDE SAVES LIVES

KEEPING icy streets safe for pedestrians and motorists is a severe job. Cinders and sand are not enough. They brush away easily when ice is smooth and hard. They need replacing constantly. They are not adequate.

Mix Calcium Chloride into your ice control abrasives. It immediately anchors gritty materials into the ice, even in coldest weather. Icy roads are made safe to travel upon.

Stock piles can be prepared at proper locations by mixing alternate layers of Calcium Chloride and grits. If no such piles are available, the material can be prepared on the load either with flake Calcium Chloride or its solution.

Be ready! Be safe! Save lives by using this proven, quick, dependable method to make icy streets safe.

Write for complete data on the use of Calcium Chloride for ice control.

CALCIUM CHLORIDE ASSOCIATION

THE DOW CHEMICAL COMPANY . . . . . Midland, Michigan
THE COLUMBIA ALKALI CORPORATION . . . . . Barberton, Ohio
SOLVAY SALES CORPORATION . . . . . 61 Broadway, New York City
MICHIGAN ALKALI COMPANY . . . . . 10 East 40th St., New York City

CALCIUM CHLORIDE
FOR ICE CONTROL

Table of Contents.....7; Industrial Literature.....45; Directory of Consulting Engineers.....41-42; Advertising Index.....50

Here's the answer to your

FILL SETTLEMENT DATA

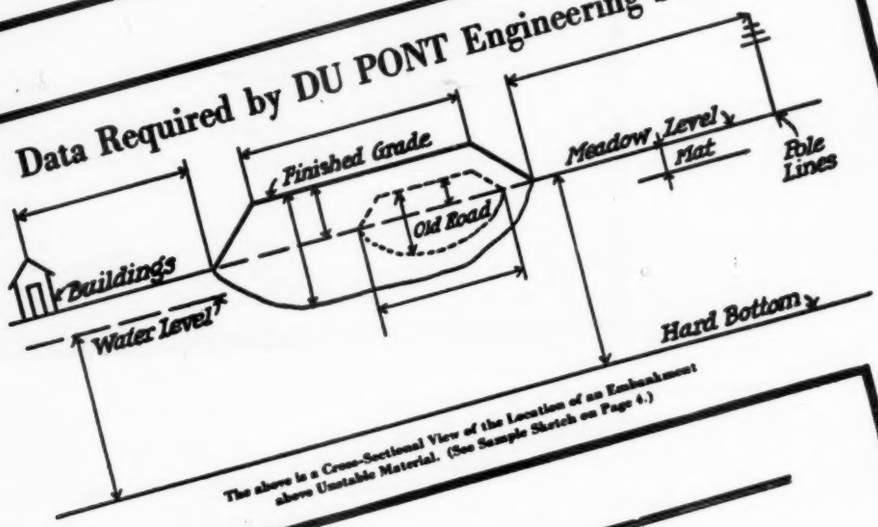
To enable our explosive engineers to prepare and submit a practical plan showing the location, quantity and kind of explosives required to solve your Fill Settlement problem, please give us a detailed description of the project. On the inside of this form are diagrams indicative of data required. Also questions to be answered to aid in the preparation of the plan applicable to your project.

LOCATION OF PROJECT

STATE.....COUNTY.....PLACE.....

HIGHWAY No. FEDERAL ☐, STATE ☐ OR COUNTY ☐ (Please indicate which.)

Data Required by DU PONT Engineering Staff



The above is a Cross-Sectional View of the Location of an Embankment above Unstable Material. (See Sample Sketch on Page 4.)

RECOMMENDATIONS

In accordance with data stated on the preceding pages of this form, and after a careful study of the conditions as presented, we submit the following recommendations for the use of du Pont Explosives to displace the unstable material beneath embankments located on

Highway No.....in.....State of.....and identified as Project No.....

Fill Settlement problem

Write out a description of your Fill Settlement project in du Pont's new "FILL SETTLEMENT DATA" folder. Du Pont Explosive Engineers tell you what blasting method to use—and the quantity and kind of explosives to use

DU PONT OFFERS a new service to highway engineers, contractors, road builders! If you have a Fill Settlement project and want more information on the most satisfactory way to use dynamite for it—simply write to du Pont for a "FILL SETTLEMENT DATA" folder.

This "DATA" folder—the first of its kind ever to appear—has been developed especially for your benefit. Du Pont will gladly supply you with one or more folders.

When you receive your folder, you write in a description of your project; fill out, on a cross-sectional drawing, the distances and depths; answer questions relating to the project; and furnish profiles of bottom of fill, and hard bottom.

CIRCLE—Ditches blasted at the toe of the fill slope relieve natural side pressure, and break up any bridging effect between the fill and the mat surface of the swamp.

With this information, du Pont Explosive Engineers can give you accurate recommendations. Du Pont engineers have studied every phase of Fill Settlement work over a number of years. They have developed three different methods of blasting which singly, or in combination, will fit any Fill Settlement project in any section of the country. They will tell you the method that will fit *your* project.

If you want to cut down maintenance costs—if you want to use dynamite to remove the unstable material below highway embankments in the most efficient manner — write to du Pont TODAY for your "FILL SETTLEMENT DATA" folder.

Then—fill it out—and return to du Pont.

SQUARE—Dynamite for the underfill charges were loaded in three lines of holes through second-hand pipe driven to the proper depth. These loads were in place before the ditch shots were made, and were fired immediately following the above shot.

DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY, Inc.

Explosives Department . . . Wilmington, Delaware

BUFFALO-SPRINGFIELD ROLLERS

Time . . .

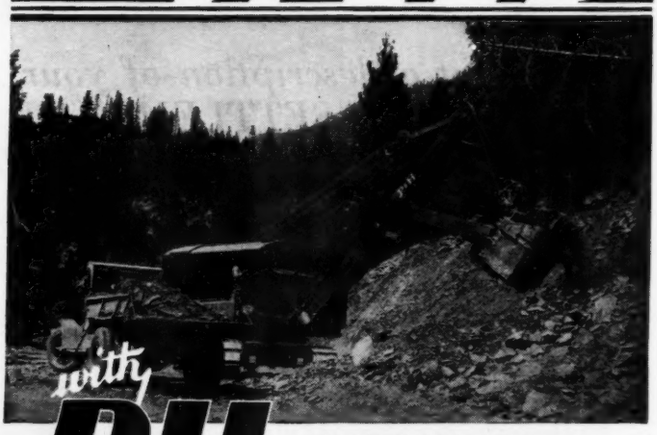
A vital factor on many contracts, as every contractor knows. Time, the loss of which may quickly turn a prospective profit into a certain loss. . . . In so far as rolling operations go, insure yourself by employing the roller in which you can place greatest dependence —the Buffalo-Springfield.

Three wheel and tandems, steam or motor driven. Range of sizes and weights. Scarifier and other attachments optional.

THE BUFFALO-SPRINGFIELD ROLLER CO.

SPRINGFIELD, OHIO

Greater POWER higher SPEED



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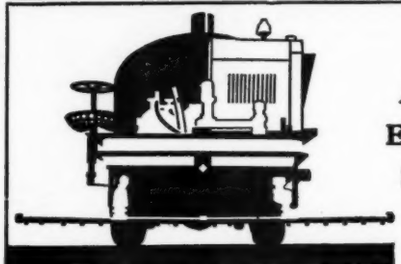

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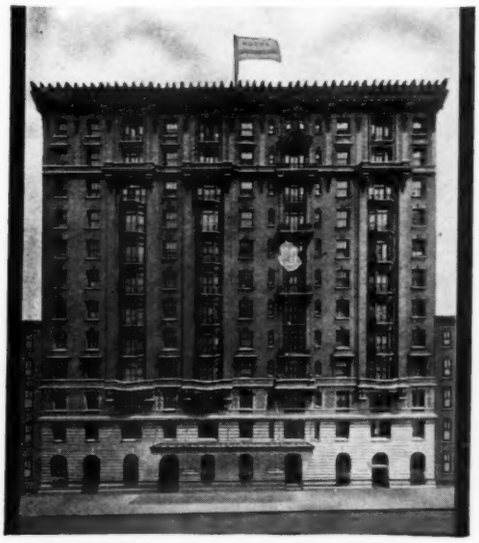

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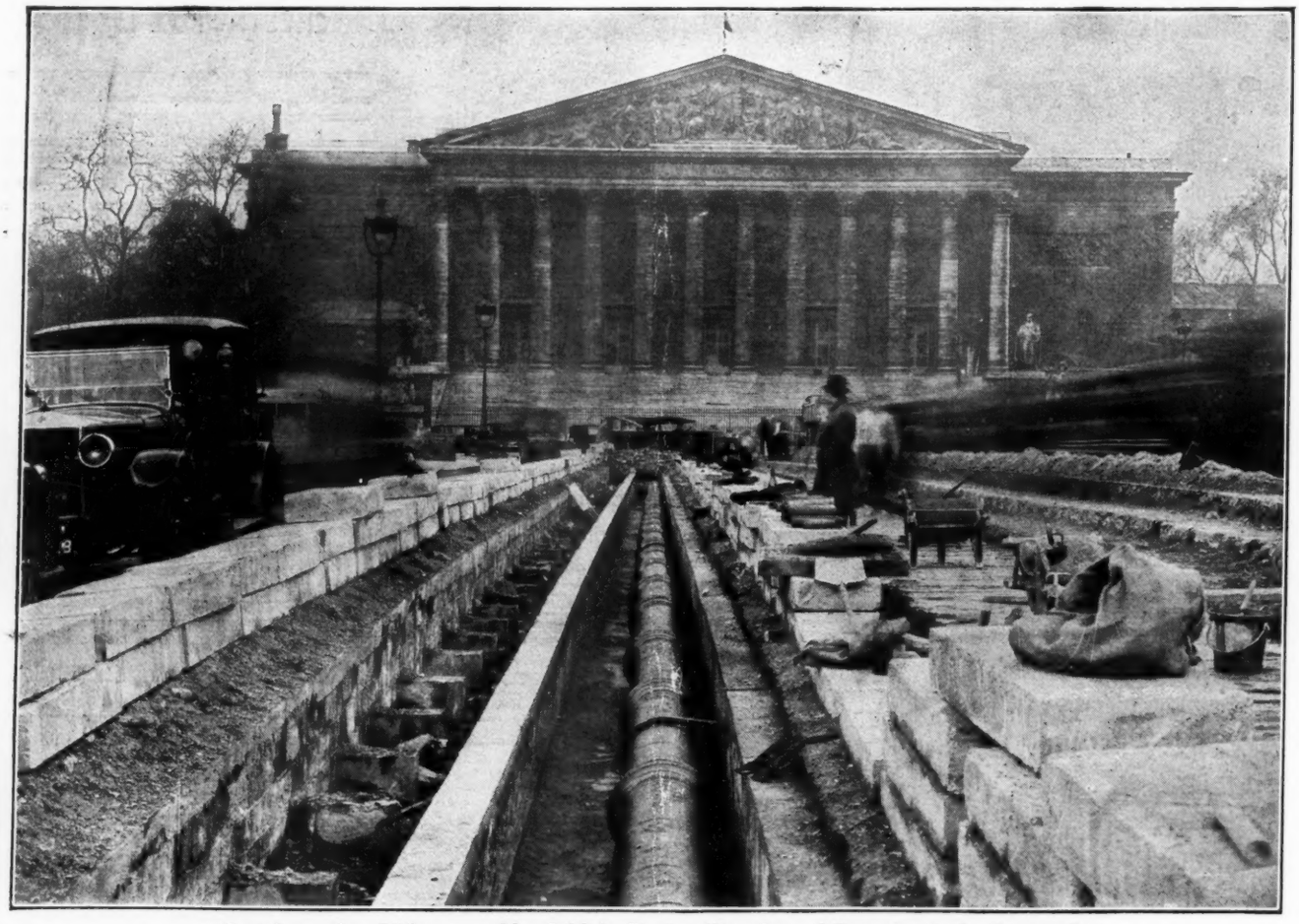
Cast Iron Mains
are tax-savers the world over



Cast iron pipe 106 years old relaid in Paris. Chamber of Deputies in background

THE unretouched photograph reproduced above shows cast iron pipe, more than a century old, being relaid across the Pont de la Concorde in Paris. This famous bridge spans the Seine from the Place de la Concorde to the Chamber of Deputies. The pipe was laid about 1825 and, after serving for more than a century, was taken up and relaid intact in 1931. Every pipe was in sufficiently good condition to be immediately relaid, and the rest of the original pipe line to which this section belonged is still in active service.

Cast iron mains are tax-savers the world over. In Paris, London, Philadelphia, St. Louis and other American cities, cast iron mains that were laid over 100 years ago are still in service, having saved francs and pounds and dollars for millions of taxpayers.

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The reason for the long life of cast iron pipe is its effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it.

• • •

For further information, write to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 122 South Michigan Ave., Chicago, Ill.

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